FOR
BETTER MANAGEMENT
OF
PLANT OPERATIONS

FACTORY

december 1961

PRICE ONE DOLLAR

A McGRAW-HILL PUBLICATION

AUTOMATE PLANT PROTECTION
p. 60

WHAT INDUSTRY LEARNED FROM CARLA
p. 76

ELECTRONIC MONITORING: TOOL OR TYRANT?
p. 92

COVER STORY
NEW WAY TO MEASURE PLANT OPERATIONS
p. 69

Airless Spray—Painting's Newest Cost Cutter

That painter up on the scaffold is using a new, highly efficient *airless* spray outfit. With it, he's laying on a full "wet" coat of paint; getting ample film build with one pass, without spray fog; and he's working comfortably at a speed that's 5 times faster than contact application methods. We call this outfit: The DeVilbiss 5-gallon portable airless. You'll call it the most important improvement in painting convenience in decades. It's tailor-made for the hundreds of one-man paint jobs in and around large structures like this hangar—or like your plant. It's compact and simple. A 5-gallon tank, built-in pump, regulator, hose, airless spray gun—that's it. One man can easily tote its 17 pounds anywhere. Write for folder I-3504 or, better yet, check the Yellow Pages for our nearest representative. The DeVilbiss Company, Toledo 1, Ohio. Also Barrie, Ontario; São Paulo, Brazil; and London, England. Offices in principal cities.

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THE tough customers in this case are those pistons—millions of them; oily, sharp-edged—which travel the production line on conveyor belts. Keeping the pistons moving was so tough that it ruined belts in only 4 months. Their sharp edges cut grooves in the belts, ripped them. Oil soaked into the belt covers, softened them, formed a dirty scum on the surface. Belts had to be cleaned and repaired constantly.

When a B.F.Goodrich distributor heard of the problem, he recommended a BFG conveyor belt made of Koroseal vinyl. Koroseal resists scuffing, tearing, cutting; it stands oil, grease, most acids and just about everything else that ruins other materials. It can be vulcanized into a continuous belt, eliminating troublesome fasteners. And since oil can't soak into its smooth, polished surface, a Koroseal belt wipes clean easily, quickly.

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Koroseal—T. M. Reg. U. S. Pat. Off.

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CONVEYOR BELTS

FOR BETTER
• PLANT MAINTENANCE & ENGINEERING
• PRODUCTION
• PLANT MANAGEMENT

DECEMBER 1961

FACTORY

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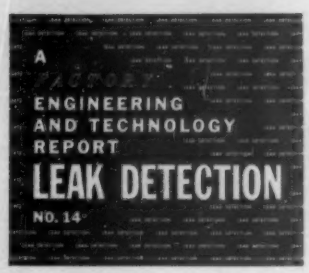

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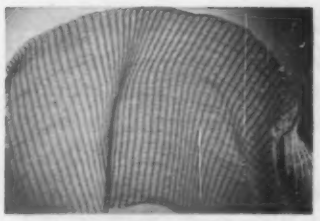

In January we'll bring you a round-up of tools, techniques, and materials just out of the R&D labs, waiting for industry to grab them up. Also in January, there will be your preview of the 1962 Plant Engineering and Maintenance Show and Conference in Philadelphia. We'll have a map of Convention Hall, a list of exhibitors, a rundown of products you'll see there, and a conference program.

COVER

Plant Manager Mark Templeton, Development and Maintenance Engineer Oscar Graveley, and Arthur M. Killin, Asst. to Works Manager (left to right), check the plugging of a submerged arc furnace at Union Carbide Metals Company's Marietta, Ohio, plant. *Painting by Frank Lacano*

FACTORY **70TH YEAR OF PUBLICATION**
December 1961 Vol. 119 No. 12
Published monthly by McGraw-Hill Publishing Company, Inc. U. S. subscription rate for individuals in the field of publication: $3 per year; single copies: $1. Canadian and foreign rates on request.
Executive, Editorial, Circulation, and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. printed in Albany, N. Y.; second-class mail postage paid at Albany, N. Y., and at additional mailing offices.
Postmaster: Please send Form 3579 to Fulfillment Manager, FACTORY, 330 West 42nd Street, New York 36, N. Y.

Turn the page for FACTORY'S Problem-Solving Guide

PROBLEM-SOLVING GUIDE

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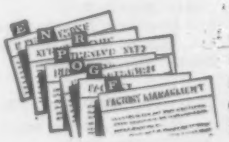

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1. All major articles (set here in bold type) and many short items are classified according to a functional code.

2. Certain articles are also coded (see numbers in parentheses) to show secondary or closely related topics.

3. To use, cut up the items below. Paste them on 3x5-in. cards, file by code number. To cross-index, copy information on a second card, file by secondary code.

For ways to use your Guide, write Reader Service, FACTORY, 330 W. 42nd St., New York 36.

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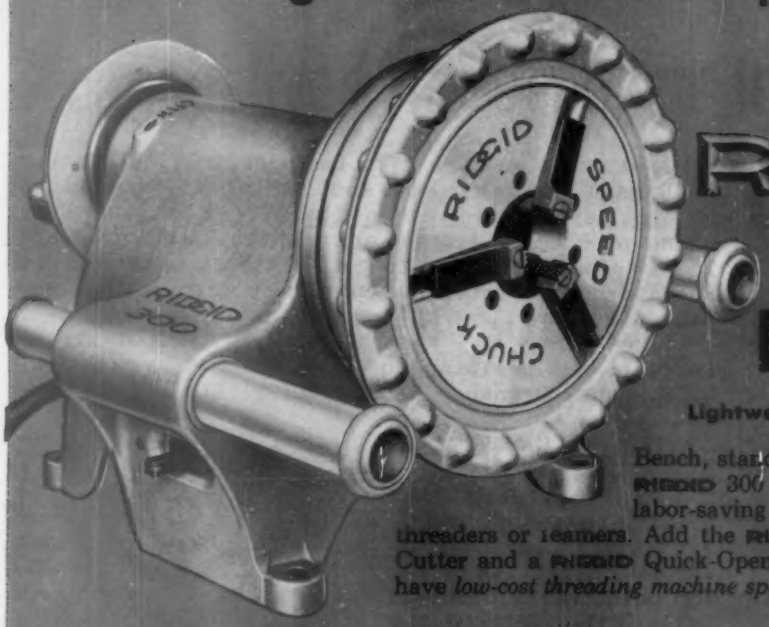
Time-Saving Power For Your Shop or on the Job...



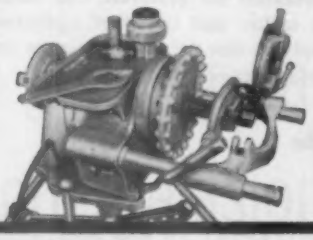
New RIDGID 300 Power Drive

Lightweight • Versatile • Low in Price

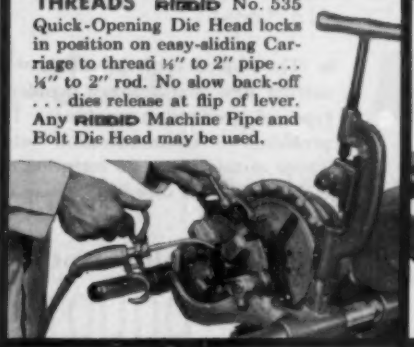
Bench, stand or truck mounted, this compact RIDGID 300 Power Drive gives you time and labor-saving power for your hand cutters, threaders or reamers. Add the RIDGID No. 310 Carriage, No. 360 Cutter and a RIDGID Quick-Opening Machine Die Head, and you have *low-cost threading machine speed and ease!*

Here's What it Does!

CUTS RIDGID No. 360 Cutter, shown here, cuts ⅛" to 2" pipe and conduit — up to ¼" rod. Extra-wide rolls keep cutter straight for perfect high-speed tracking. Cutter stays back out-of-way when not in use.



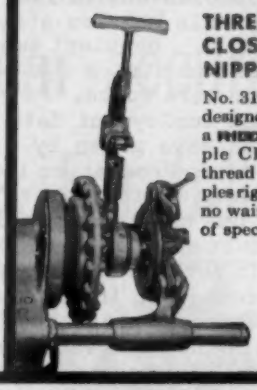
THREADS RIDGID No. 535 Quick-Opening Die Head locks in position on easy-sliding Carriage to thread ⅛" to 2" pipe... ¼" to 2" rod. No slow back-off ... dies release at flip of lever. Any RIDGID Machine Pipe and Bolt Die Head may be used.



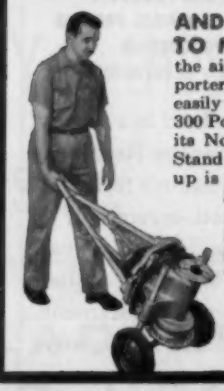
REAMS 300 Power Drive does all the work. Heat treated cutting edges of RIDGID "LonGrip" Reamer won't dig in . . . produce smooth pipe or conduit walls in seconds.

DRIVES GEARED THREADERS Compact, RIDGID No. 300 Power Drive has plenty of power for up to 12" geared tools. New RIDGID Close-Coupled drive shown here, for Nos. 141 and 161 Jam-Proof Threaders eliminates Universal Drive Shaft . . . saves working space.

THREADS CLOSE NIPPLES No. 310 Carriage is so designed that by using a RIDGID No. 19 Nipple Chuck you can thread even close nipples right on the job... no waiting for nipples of special lengths.



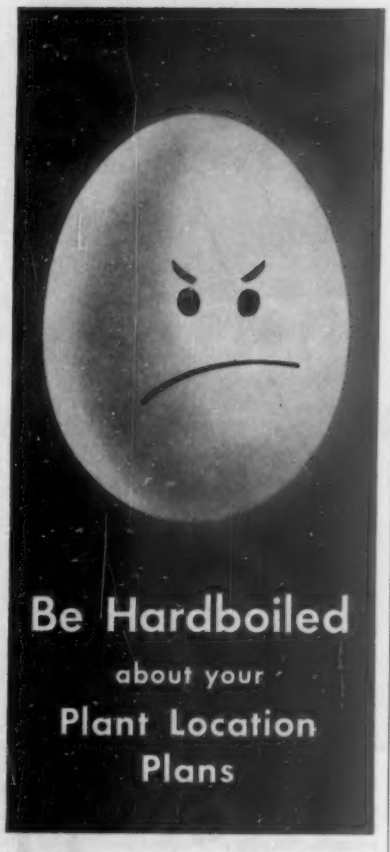
AND IS EASY TO MOVE With the aid of the Transporter, one man can easily move a RIDGID 300 Power Drive with its No. 1206 Folding Stand attached. Set-up is fast and easy. Stand's integral tool tray locks legs in position, forming rigid work base.



Save Time and Increase Your Profits on Every Job. See and Try This Biggest "Threading Machine" Bargain at your Supply House!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.



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THE TOLEDO EDISON COMPANY
an investor-owned electric light and power company serving Northwestern Ohio

LETTERS

Numerical problems

Dear Sir:

"Zeroing in on Zero Downtime" (FACTORY, September 1961, page 112) gets at the basic problems of numerical control maintenance in a most practical manner. Many of the problems discussed are identical with problems in our plant. We hope to get more information about Rocketdyne's maintenance system by writing the company directly.

C. O. Strawn
Production Superintendent
U. S. Naval Ordnance Plant, Louisville, Ky.

Dear Sir:

In your article, "Zeroing in on Zero Downtime," it appears that our Cimtrol numerical control equipment was singled out for condemnation. Other equipment was not identified by manufacturer's name in discussing maintenance problems. It is difficult for us to believe that FACTORY did this intentionally.

Charles M. Reesey
Vice President
Cincinnati Milling and Grinding Machines, Inc.
Cincinnati

► **The objective of the article was to explain Rocketdyne's approach to solving new maintenance problems created by the introduction of new types of production machines. The problems are universal, and include problems of communication between maker and buyer of equipment. There certainly was no intention of implying that the problems arose only with equipment supplied by one manufacturer.—ED.**

The unemployment puzzle

Dear Sir:

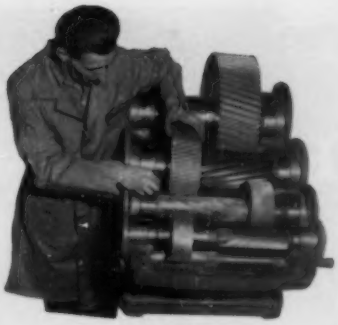
Two conclusions in your editorial in the September issue puzzle me. You state: "The service industries have the . . . heaviest employment swings." Also, "It is these industries that must take up the slack in the American work force."

Annual employment data from 1948 show service industries have grown by 7 million without any swing whatsoever. Production industries have dropped a million; manufacturing (a category of production industries) has had trouble holding a gain of one million.

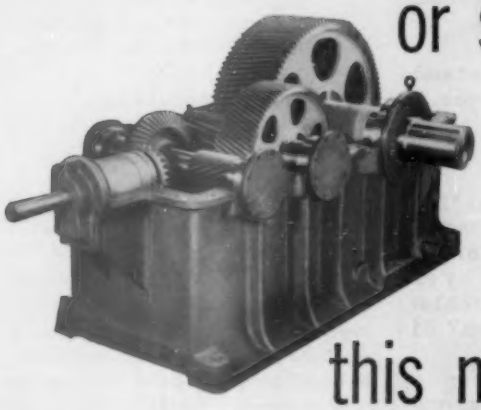
No doubt substantial employment growth must and will occur in service industries. As the editorial points out, production industries have been forced by union and government pressures to solve cost problems by introducing new processes, equipment, and labor-saving devices. I am certain the same trend will take place in most service industries. Any surge in employment in services will be a temporary stopgap in the decade ahead with respect to the unemployment problem.

I wonder if the problem hasn't grown beyond the grasp of today's industrialist who views problems from engineering and profit-generating standpoints. I wonder

If you need gear drives that can deliver more power in less space... reduce vibration



or sound levels... or operate at higher speeds yet last longer... look for this nameplate.



It means that drive gearing has been hardened and precision ground to give radically improved gear accuracies. Yet they cost no more. For full details...

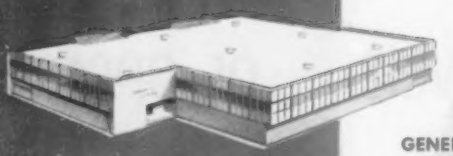
write on your company letterhead for "An Advanced Concept in Modern Gearing"

AGMA
MEMBER

PHILADELPHIA GEAR DRIVES

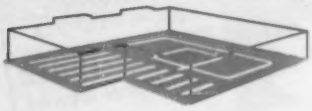
PHILADELPHIA GEAR CORPORATION
King of Prussia (Suburban Philadelphia), Pa.

with
Faultless
Casters You Can Utilize Production Space Efficiently . . . and Change Plant Layout as Needed!



Today, your production line can move in a serpentine pattern

. . . tomorrow it can be changed to a straight-line or circular flow



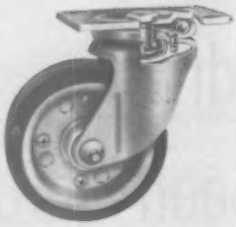
A fluid Faultless Castered production line is quickly reshaped as needed . . . to suit new products, design changes, retooling, time-and-motion study recommendations, etc. Also Faultless Castered trucks, dollies, racks, carts can transport your manufactured products outdoors for yard stocking. Whatever your production line load requirements, floor surfaces, space limitations, Faultless engineers the precision casters to meet your specific requirements and limitations.

ASK YOUR DISTRIBUTOR: Your nearby Faultless Industrial Distributor maintains a substantial inventory of Faultless Casters for immediate delivery. He and one of the strategically located Faultless Sales Engineers are available to work with you on every handling problem in your plant. Or write for complete information.

GENERAL DUTY SERIES 100 CASTER

LIGHT DUTY SERIES 400 CASTER

MEDIUM DUTY SERIES L900 CASTER



HEAVY DUTY SERIES H900 CASTER

EXTRA-HEAVY DUTY SERIES 1300 CASTER

NOELTING Faultless Casters

Faultless Caster Corp.
Evansville 7, Indiana
Branch Offices in principal cities; see the Yellow Pages of the telephone book under "Casters".
Canada: Stratford, Ontario

Begins on page 6

LETTERS

if it isn't time for industrialists and the government to call in experts from other walks of life to advise on what people can do with their times besides holding jobs for dollar income. I wonder if the problem is an "unemployment" problem. Aren't all industries just means to the end of satisfying the needs of people? Who says that all people have to be employed to have their needs satisfied?

T. Allen Lynch
Manager
Employee Communications
Kaiser Steel Corp.
Fontana, Calif.

► **Reference to swings in employment in service industries was intended to apply to seasonal rather than business-cycle swings. The other conclusion is based on the premise that anyone who wants work should be able to find it. Everything we know about manufacturing techniques seems to forecast a continued decline in the ratio of manufacturing to total employment. Thus, industries other than manufacturing must provide the jobs.—ED.**

Good idea, but wrong name

Dear Sir:

"Inspection on the Line," page 86 of the October issue of FACTORY, describes an application of our Examolite fixtures for color matching. But the article gives an incorrect name for the manufacturer of the equipment.

Examolite is a registered trademark owned by Macbeth Daylighting Corporation, Newburgh, N.Y., and the product is made exclusively by this firm. Furthermore,

FACTORY welcomes opinions and suggestions from its readers. They help us put management problems in better perspective. Letters should be addressed: The Editor, FACTORY, 330 West 42nd St., New York 36.

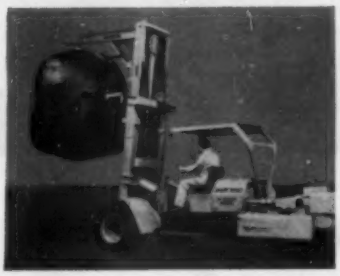
For more facts Circle 410 on Reader Service Card

FOR LEASE:

(A materials handling system that cuts costs in six basic areas)

Example: The SEALDBIN container above has a volume of 300 cubic feet. It has produced these results: (1) Cost of disposable containers was eliminated; (2) Loading and unloading is effected in just one hoist, compared to many hours of bag handling; (3) One man fills or empties the SEALDBIN in 10 or 15 minutes; (4) Material loss through broken bags, moisture, contamination and pilferage was eliminated; (5) Transportation costs were lowered because SEALDBINS can be shipped on open flatcars, decks or trucks; (6) Warehousing costs were eliminated because SEALDBINS are their own protection and may be stored outdoors.

The entire U.S. SEALDBULK SYSTEM may be leased, which means no capital investment. Explore the U.S. SEALDBULK SYSTEM further. Write for Bulletin CP-59-41.



U.S. Sealdbins now being used for Polypropylene, Polyethylene, Soda Ash, Caustic Flake, Ammonium Nitrate, Aluminum Chloride, and many other dry, flowable materials.

United States Rubber

Inflatable Products and Transportation Containers Dept.
10 Eagle Street, Providence, R. I.

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increasing productivity at Westinghouse

Westinghouse's Transformer Division uses an Electrowriter System to reduce blueprint/document delivery time from two hours to thirty minutes. Engineers formerly spent needless time walking requests for urgently needed drawings to the blueprint and document vaults. Now, by simply writing on a nearby Electrowriter unit, such requests are instantaneously recorded, unattended, in the drawing vaults. Drawings are pulled and delivered. *Write today* for a complete explanation of this and other Electrowriter Systems. Write *Electrowriter Sales Division, Victor Comptometer Corporation, 3900 N. Rockwell Street, Chicago 18, Illinois.*

Electrowriter®

COMMUNICATION SYSTEMS BY
VICTOR COMPTOMETER

®Electrowriter—Trademark Registered U.S. Patent Office

Begins on page 6

LETTERS

there is no connection between this company and the one named in your article.

Robert E. Meeker
Vice President
Macbeth Daylighting Corp.
Newburgh, N.Y.

► **Our apologies to both companies for this mistake.—ED.**

Calculation question

Dear Sir:

On page 102 of your article on "Shelving" (September 1961, page 99) 31.5 cubic feet is given as the volume of 36"x18"x7'3" shelf space. Shouldn't the volume be 32 5/8 cubic feet?

Leo P. Birzstein
Vice President
Bro-Dart Industries
Newark, N.J.

► **Useful volume is 31.5 cubic feet. We neglected to say that 3 inches of the height is considered dead space at the foundation of the shelving.—ED.**

FACTORY

December 1961 Vol. 119, No. 12

A consolidation of Factory Management and Maintenance and Factory and Industrial Management, including Factory, and Maintenance Engineering. Published monthly by McGraw-Hill Publishing Co., Inc. James H. McGraw (1860-1948), Founder.

Executive, Editorial, Circulation, and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N.Y. Telephone: Longacre 4-3000. Teletype: TWX N.Y. 1-1636. Cable address: McGRAWHILL, N.Y.

Printed in Albany, N.Y.; second-class mail postage paid at Albany, N.Y., and at additional mailing offices. Title ® Registered in U.S. Patent Office.

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Hey, Herman... Snap-Tite valved couplings come in big sizes too!

There's a size and type to handle almost anything that flows

Snap-Tite can provide the right size valved coupling for most any use . . . with quick off-on action wherever coupling or shut-off is required.

"H" series valved couplings for high pressure applications. High resistance to heavy line surge. Sizes from 1/8" through 6". Larger sizes on special order.

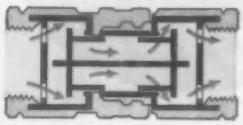
"IH" series valved couplings for greater impact in air lines. 1/8" through 1/2".

"E" series valved couplings for vacuum and very low pressure. Recommended for gravity flow. Sizes from 1/8" to 6". Larger sizes on special order.

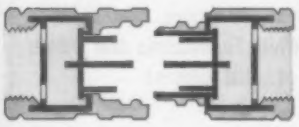
"T" series valved couplings for hard to handle fluids. The only valved quick-disconnect couplings now on the market for fluid temperatures from −40°F to +400°F. Sizes from 1/2" through 3".

Snap-Tite valved couplings are available with two-way or one-way automatic line shut-off. They are normally furnished in alloy steel. Also available in brass, aluminum, or stainless steel with a variety of finishes.

TO USE SNAP-TITE VALVED COUPLING:



CONNECT—Full flow instantly



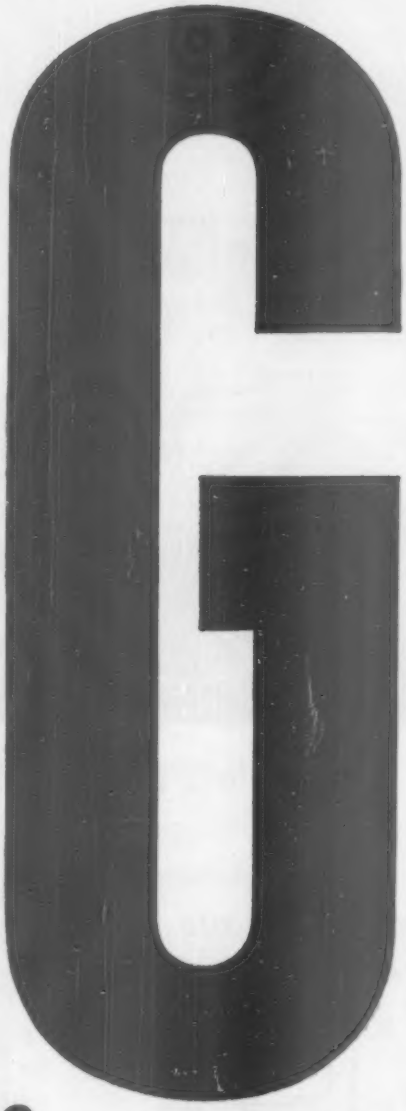
DISCONNECT—No flow instantly

Write for Snap-Tite Catalog No. 58 for more information on Snap-Tite valved couplings.

☆ Snap-tite
UNION CITY, PA.

ST-59-02

INSIST ON ALL THESE VALUE-



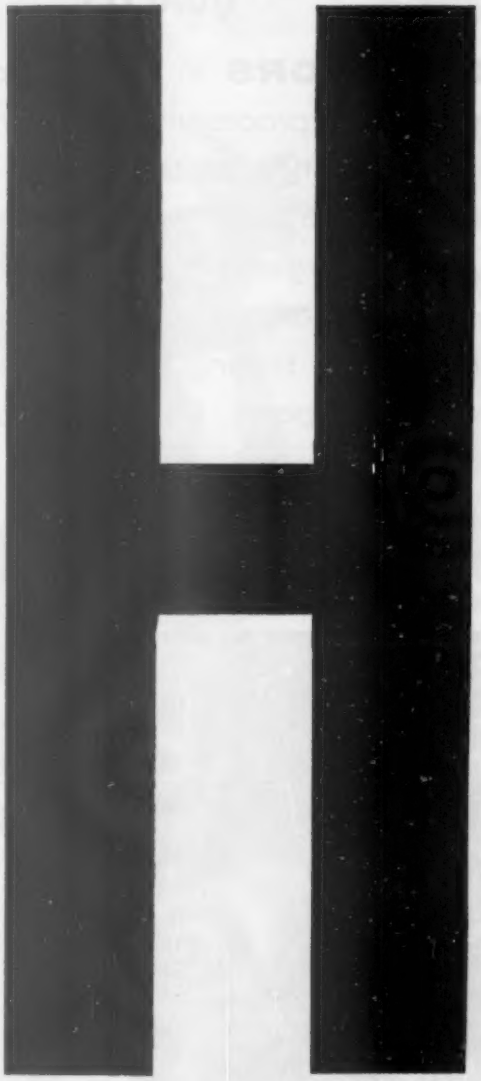
Lumens—Westinghouse 40 watt Cool White Fluorescents produce the high light output needed for normal working conditions. **Where more light is desired, use Westinghouse High Efficiency Fluorescents—3,330 lumens—brightest 40 watt fluorescents available today. Both $1.30 list.**

Installation economy—You don't have to change fixtures, ballasts, or lampholders to enjoy the benefits of better lighting from these Westinghouse lamps.

Greater lumen maintenance—Maintained light output is just as important as initial output. Even at 10,000 hours, Westinghouse 40 watt Cool White Fluorescents still deliver a terrific 80% of initial lumens!

Westinghouse Lamp Division, Westinghouse Electric Corporation, Bloomfield, N.J.
FACTORY

FACTORS WHEN YOU BUY



Hours of life—Because the actual performance of Westinghouse fluorescent lamps far exceeds rated life, you get additional hours of lamp life . . . greater light value . . . at no additional cost.

Trouble-free performance—Years of in-service use prove early burn-outs are rare, discoloration is minimum. Quality performance with user-proved Westinghouse lamps is guaranteed!

You can be sure . . . if it's

Westinghouse

For more facts Circle 414 on Reader Service Card

Otis

WORLD'S WORD FOR ELEVATOR QUALITY

DOLE USES OTIS FREIGHT ELEVATORS in its production line to move canned pineapple to storage after processing. They transport 275-million cans a year. Since 1953, DOLE has protected this vital production capacity with dependable OTIS elevator maintenance. Is elevator maintenance complex? Yes! It is an organization task requiring an unusual combination of skills. Plus a wide knowledge of parts, assemblies, functions, replacement procedures, testing and adjusting. Plus the availability of original replacement parts. Plus immediate service in emergencies.

OTIS ELEVATOR COMPANY • 260 ELEVENTH AVENUE • NEW YORK 1, N.Y.
OFFICES IN 297 CITIES ACROSS THE UNITED STATES AND CANADA

FACTORY

Dole

WORLD'S LARGEST FRUIT CANNERY

275,000,000 CANS OF PINEAPPLE PRODUCTS are grown, processed and packaged each year by DOLE. This fruit, picked from 30,000 nearby acres, amounts to 40% of Hawaii's output. DOLE requires only 15 minutes to process a pineapple once it has entered the cannery. Growing a pineapple is a much slower process! It takes between 18 and 24 months for a new plant to produce a mature fruit. Each year, 100-million slips are planted by hand. One man inserts about 8,000 slips into the ground in an 8-hour day.

YOU CAN'T HAVE THIS COPY

The man it belongs to wouldn't even lend it to you. He gets into roofing problems regularly, and he wants his Lion Roofing Manual handy.

He knows from experience that it is the first complete roofing manual ever written. He also knows he can find a quick, clear answer to almost any roofing question in its 36 pages.

Here are some of the subjects covered:

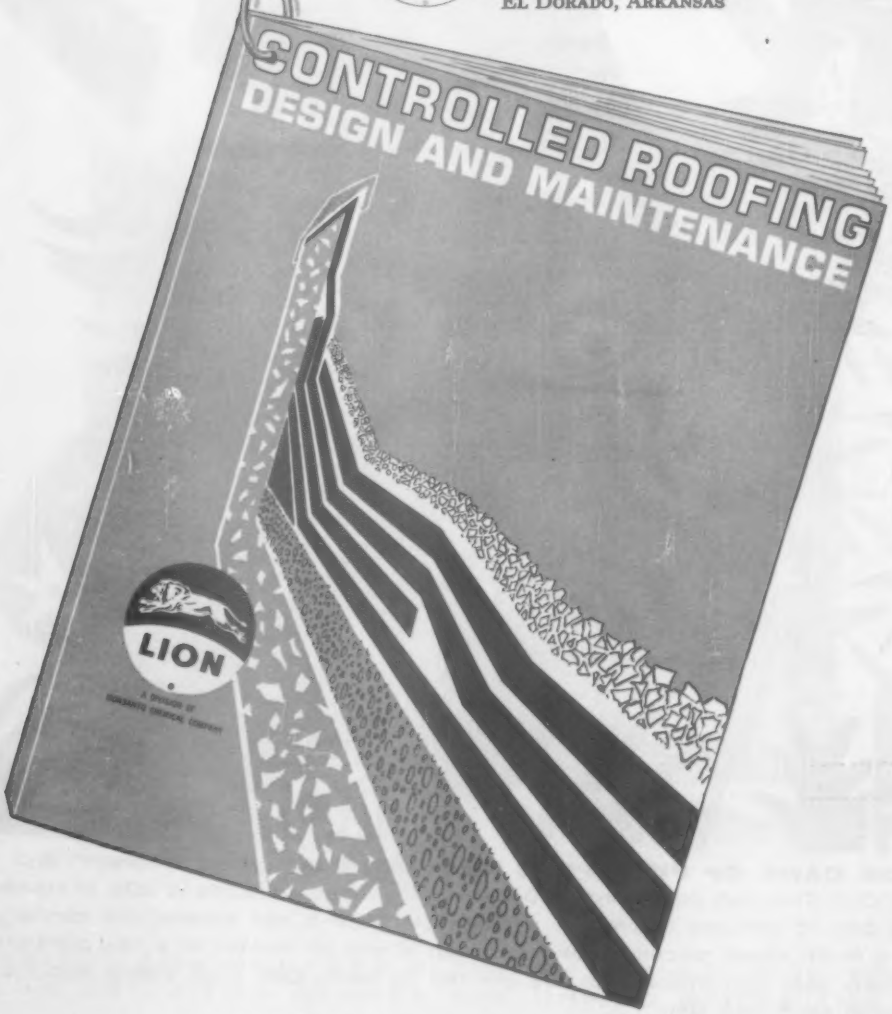
- Roofing System Deterioration
- Vapor Effects
- Stress Effects
- Design Considerations
- Roofing Maintenance
- Cleaning
- Spot Repair
- Recoating
- Reroofing
- Flashings

Send us your name and we'll send you a manual which includes typical specifications for complete roof construction.

Protective Coatings Section 14

LION OIL COMPANY

A Division of Monsanto Chemical Company
El Dorado, Arkansas



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we can prove it!

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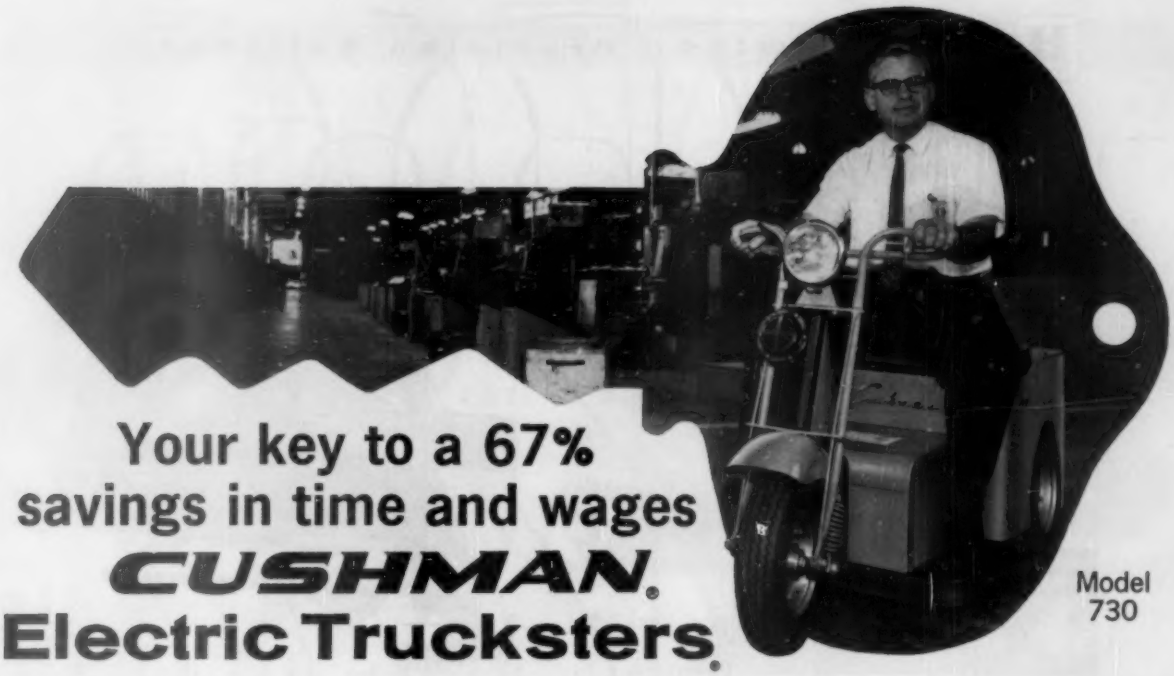
If you own, rent or use light vehicles either on-the-street or in-plant... CUSHMAN offers you the lowest cost-per-mile transportation in America today!

Check card for your FREE copy of Electric Truckster Time-Study Work Folder.



Your key to a 67% savings in time and wages

CUSHMAN® Electric Trucksters®

Model 730

Cushman puts safe, low-cost wheels under your supervisors, maintenance men, messengers and other employees on the move inside the plant—cuts unproductive "travel time" by 67%. Sturdy, dependable, practically maintenance free, the Model 730 Electric Truckster is only 25 inches wide, travels up to 40 miles on a charge. For added utility it has a hinged storage compartment and optional tandem seat for passenger.

	WAGE	TRAVEL	SPEED	TIME	COST
FOREMAN ON FOOT	$4.00 per hr.	15,450 feet per day	2½ mph	72 min.	$4.80 per day
FOREMAN ON ELECTRIC TRUCKSTER	$4.00 per hr.	15,450 feet per day	7½ mph	24 min.	$1.60 per day

Based on these typical figures you save $3.20 per man per day!

CUSHMAN vehicles... designed with your plant requirements in mind

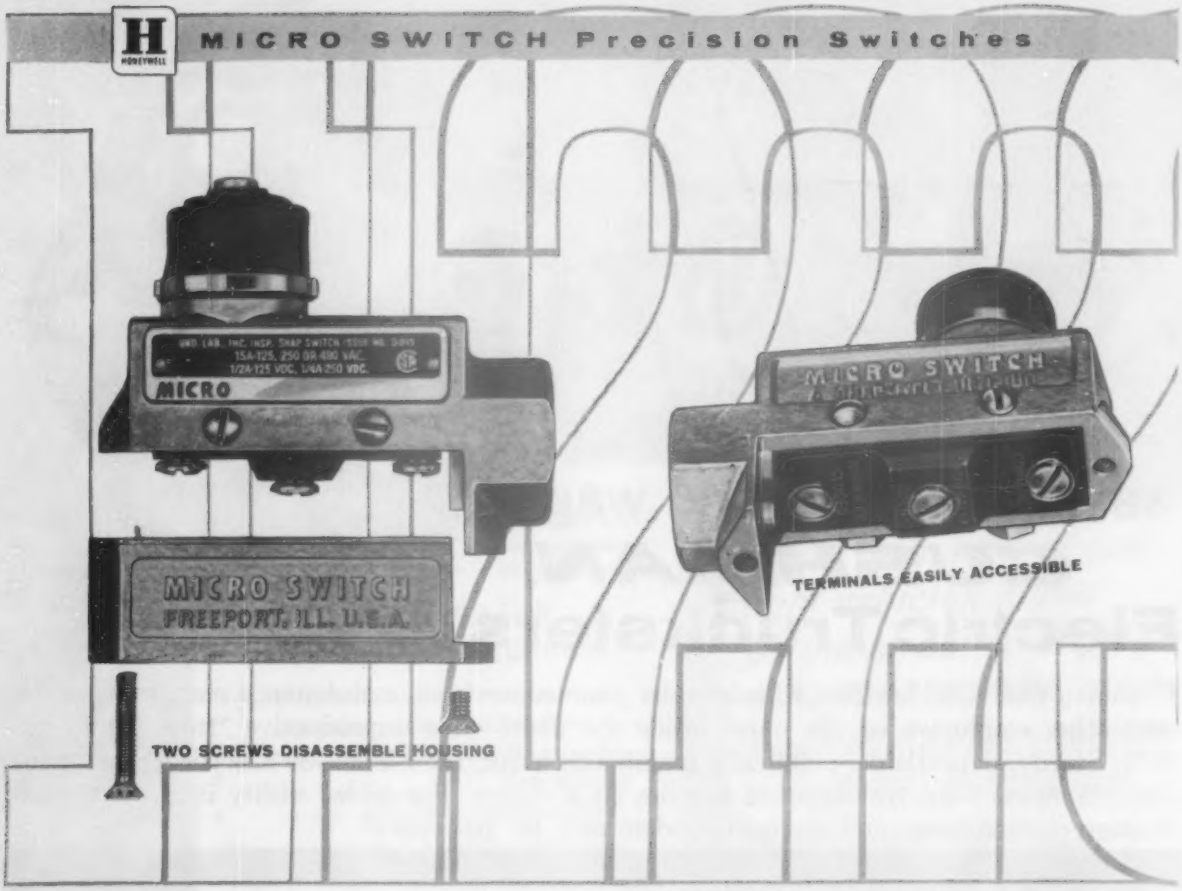
MODEL 731 ELECTRIC TRUCKSTER
Quarter-ton carrying capacity for tools, supplies. Only 38½" wide. Travels up to 40 miles on a charge.

MODEL 734 ELECTRIC TRUCKSTER
Half-ton payload capacity. Only 47½" wide. Up to 50 miles on a charge. Shown with optional personnel seat.

GASOLINE POWERED TRUCKSTER
Use it in-plant or on the street. Only 48" wide. Choice of 9 or 18 hp die-cast aluminum engine. Auxiliary transmission available.

Ask your dealer for FREE demonstration or mail postage-paid card for illustrated literature including work book to figure your own savings.

CUSHMAN MOTORS
1039 No. 21st, Lincoln, Nebraska
A subsidiary of Outboard Marine Corporation

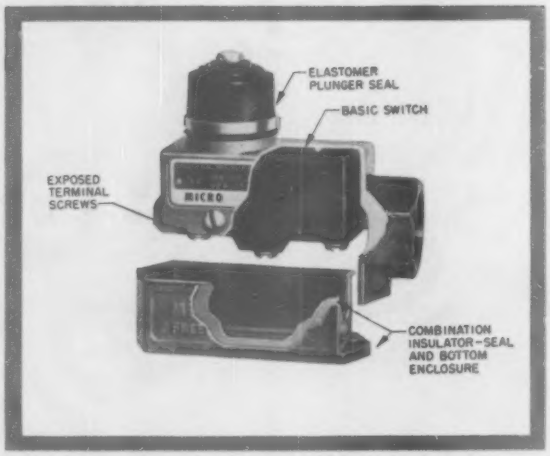


Now...fast, easy wiring in

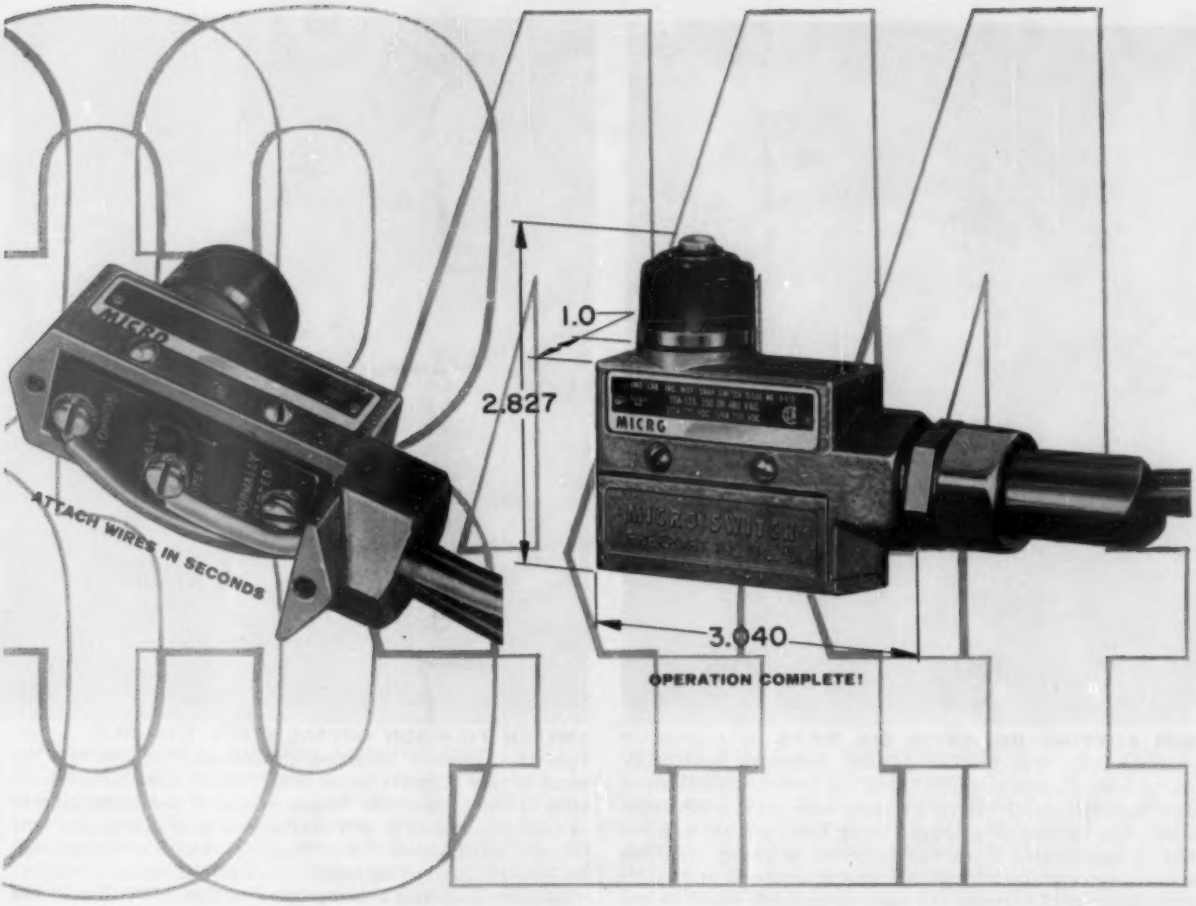
Quick and easy...a few turns of the screwdriver put switch terminals out in the open for fast wiring. The combination insulator-seal liner is permanently fastened in the bottom half of housing—can't drop out, be forgotten, or installed wrong. Even the conduit hub is hex-shaped for faster installation.

The extra-rugged "E6" and "V6" die-cast housings are sealed against dirt and oil splash. The basic switch is built for MICRO SWITCH precision action for millions of operations.

You can get these small easy-to-use switches from your nearby authorized distributor of MICRO SWITCH products. He stocks a full line of snap-action switches with a wide range of actuators and operating characteristics. See the Yellow Pages.



WRITE FOR CATALOG 83–20 PAGES OF HELPFUL INFORMATION ON ENCLOSED SWITCHES



"E6" and "V6" enclosed switches

8 DIFFERENT ACTUATORS—IN SIDE OR BASE MOUNTING DESIGNS

OVERTRAVEL PLUNGER

ELASTOMER SEALED PLUNGER

SEALED ROLLER ARM

CROSS-ROLLER PLUNGER

ROLLER PLUNGER

ONE-WAY ROLLER ARM

ROD ACTUATOR

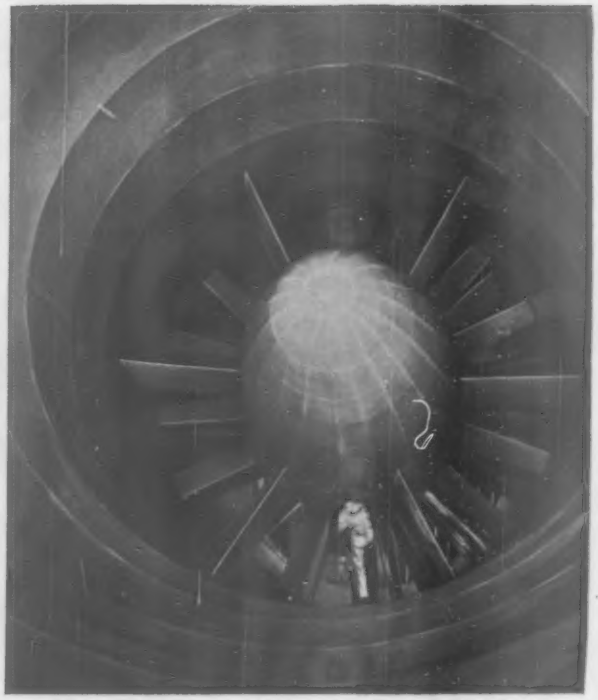
ROLLER ARM

MICRO SWITCH, FREEPORT, ILLINOIS
A division of Honeywell
In Canada: Honeywell Controls, Limited, Toronto 17, Ontario

Honeywell
MICRO SWITCH Precision Switches

For more facts Circle 418 on Reader Service Card

SUN CUTTING OIL SAVES SIX WAYS. A typewriter manufacturer was producing pins, fasteners, and other parts from Bessemer screw stock on Brown and Sharpes and New Britain Gridleys. Finishes were poor, production slow, tool life below average. Work from cut-off was too hot to handle and there was excessive smoking. Analysis showed the cutting oil was deficient in antiweld and lubricity. Sunicut 11 Cutting Oil was recommended and its use resulted in immediate improvement in all trouble areas. In addition . . . savings on oil cost alone ran $6300 a year, proof that Sun quality does not mean a premium price!



SWITCH TO A SUN GREASE STOPS TROUBLE! A system of delicately balanced propellers produces the big wind in this huge transonic wind tunnel. Control mechanisms at the roots of the blades consist of several small sets of spur gears, antifriction bearings on gear shafts, and four 10-inch antifriction thrust bearings. *Oil* was being used for lubrication, but oil leaked . . . caused unbalance, violent vibration, gear and bearing failures. Sun 1897 *Grease* was recommended. An assembly was packed; leakage stopped. After 18 months, the Sun grease was still in service; not one bearing or gear failure had occurred!

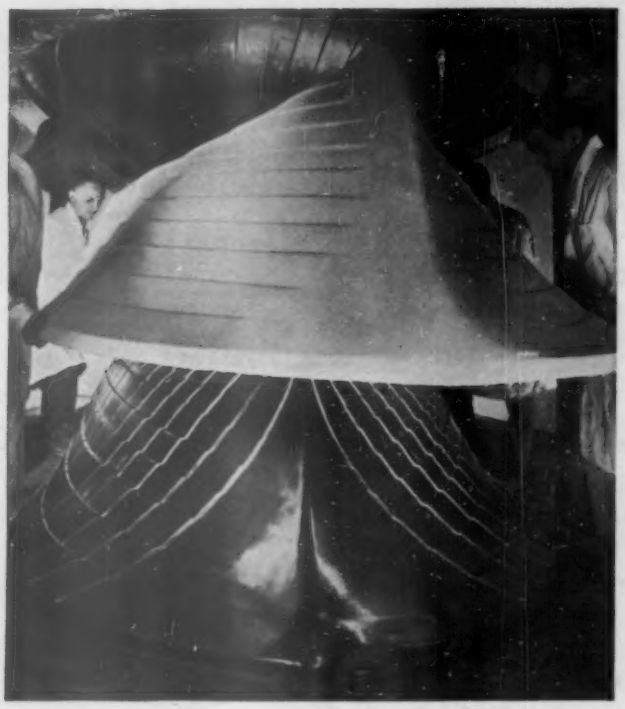
Are you stymied by the question:

SUNOCO

QUALITY . . .
THE BEST ECONOMY OF ALL

Actually,
the answer is
simple enough:

SUN OIL COMPANY



HYDRAULIC OILS, SUNOCO SERVICE CUT LOSS! A molder of fiber glass products operates several plants. In one, leakage was causing frequent downtime of six presses molding fiber glass trays. A Sun man analyzed the trouble, recommended Suntac 302, one of the many Suntac oils designed to combat leakage in hydraulic and circulating systems. At another plant, production of boat hulls like the one shown here was stymied by a contaminated oil. The Sun man swung into action . . . brought in equipment to salvage the oil, saving a sizeable sum through *service*. Now job-fitted Sun Solnus 300 is *keeping* production rolling!

SOLNUS OIL CUTS MAINTENANCE 50%! A Pennsylvania manufacturer compared performance of his regular compressor oil with Sun Solnus 300 in a Chicago Pneumatic air compressor for two rigid test periods of eight months each. The Solnus 300 cut discharge valve maintenance from 4.12 manhours per month to 1.82, intake valve maintenance from 5.68 to 3.00, and all valve maintenance from 9.87 to 4.87 . . . maintenance savings of 50%. Dollar savings ran a tidy $915 a year! Where can your Sun Representative help you save with the quality performance of the right job-fitted Sunoco product for you?

Which petroleum product?

Get the *product quality* it takes to keep you rolling . . . job-fitted by men who *know what they're doing* . . . teamed with the *service* you have a right to expect! Try a Sunoco product in your plant. It's the fastest way to convince yourself that investing in Sun quality can be good for you.

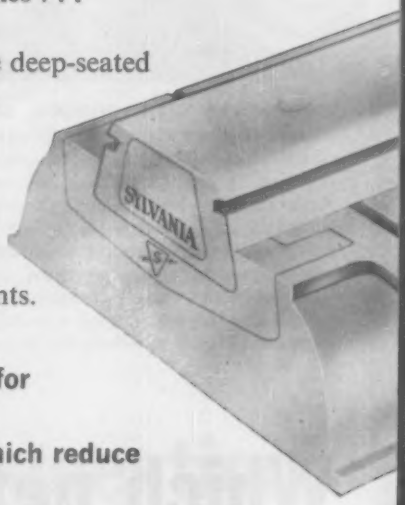
PHILADELPHIA 3, PA., DEPT. F-12 • **In Canada, Sun Oil Company Limited, Toronto and Montreal.**

Attack Indirect Costs with
The Ideal Answer to Your Industrial Lighting Problems...Sylvania's New

Here is a totally-new series of industrial lighting fixtures designed to make your lighting fixture selection simple and positive.

Sylvania's Power-V Series includes *all of the features you want* in industrial lighting equipment—ruggedness, versatility, adaptability, ease of installation and maintenance, trimness, simplicity, high efficiency, excellent lighting characteristics . . . and all at competitive prices.

This is a completely modern fixture series from the deep-seated channel design to the wide, rugged embossed reflector.



The Power-V Series is designed to provide the high level, quality lighting job you need to increase production and efficiency and to decrease rejects and accidents. Because of the wide choice of models and lamp types, you can practically custom-design a lighting system to fit your exact illumination requirements.

Each Power-V model features:

- **Reflectors with deep embossments and ribbing for strength and rigidity.**
- **Simplicity of design and labor-saving devices which reduce installation and maintenance time.**
- **Excellent lighting characteristics with 430 ma Rapid Start and Instant Start; 800 ma Rapid Start; or any size of the powerful 1500 ma Rapid Start lamps.**
- **A low silhouette to provide neat, trim appearance.**

From every angle, we believe the Power-V Series to be the finest line of industrial lighting fixtures ever produced. May we send you the details? Just write to:

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia

For New Construction or Industrial Modernization...
Be Sure to Investigate Sylvania's **Power-V** *Series*

Power-V Series

RUGGED

Strong, rigid fixtures featuring double-V embossments on reflector. Withstands rough handling or accidental bumps and abuse.

POWERFUL

Recommended footcandle levels are reached easily with Power-V . . . and you maintain quality standards, too. Designed to use 430 ma, 800 ma or all types of 1500 ma lamps.

NEAT

Trim, shallow appearance assured through positive integration of channel and reflector. Low silhouette enhances any installation.

SIMPLE

Clean design, minimum parts, labor-saving devices add up to simplicity of installation and maintenance.

LIGHTING FIXTURES BY

SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL TELEPHONE & ELECTRONICS SYSTEM

For more facts Circle 420 on Reader Service Card

Now! Any old electric hammer is worth $60 or more trade-in

on a New Skil ROTO-HAMMER

...the hammer that revolutionized masonry drilling

Your Skil distributor is ready to give you a whopping big trade-in allowance on a new Skil Roto-Hammer—*the fastest, easiest, lowest cost way to drill masonry holes!* You'll actually receive $60 or more worth of Skil Hammer accessories as your trade-in for any old electric hammer, regardless of make, model or condition.

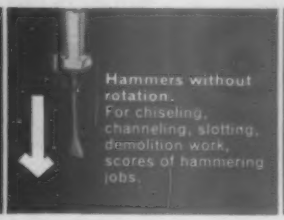
Two Roto-Hammer models are available —new, improved Model 726 (drills masonry holes from 11/16" to 1½" diameter); Model 736 (drills masonry holes from ½" to 3½" dia.).

See your Skil distributor NOW for complete information. *But hurry! This sensational trade-in offer is for a limited time only!* Look under "Tools—Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 117L, 5033 Elston Avenue, Chicago 30, Illinois.

SKIL POWER TOOLS

Only Skil Roto-Hammers have 3-way action

Hammers with automatic power rotation. For fastest, lowest cost masonry drilling without tedious hand rotation of star drills.



Hammers without rotation. For chiseling, channeling, slotting, demolition work, scores of hammering jobs.

Drills without hammering. For use same as a regular electric drill in boring wood, metal, other materials.

...and only Skil Roto-Hammers use 4 types of percussion-rotary bits...over 150 accessories in all for unequalled versatility!

For more facts Circle 421 on Reader Service Card

ACHIEVE MAJOR COST REDUCTIONS ON THE PRODUCTION LINE WITH THE *NEW*

R W **TOTA TRAY**

FLOOR-TYPE

CAROUSEL CONVEYOR

The R-W TOTA TRAY is a horizontal floor type conveyor with unique flexibility. Modular design permits the specification of length, height and speed to meet your exact requirements. Parts, components or products of up to 30 lbs. weight per load pan can be efficiently conveyed at speeds up to 50 feet per minute. Closely nested Load Carrying Pans permit more work and conveying area . . . saves floor space . . . no wasted return line. TOTA TRAY Conveyors can reduce in-process time by as much as 50%. They are economical to purchase, install and maintain . . . also adaptable for direct tie-in with R-W Overhead Conveyor Systems.

MODULAR DESIGN PROVIDES INSTALLATION VERSATILITY

TOTA TRAY Conveyors provide increased efficiency and economy in production, assembly and testing applications, selective packaging and order packing.

PRODUCTION AND ASSEMBLY . . . TOTA TRAY Conveyors assure proper distribution of work and maximum utilization of manpower and machinery in a minimum of floor space. Ideal for producing and/or assembling electronic and electrical apparatus; small appliances; accessories; instruments and many other industrial and consumer products.

TESTING AND REPAIR . . . TOTA TRAY Conveyors used on testing and/or combination testing and repair lines permit the testing of components prior to assembly . . . rejects can be pulled out to eliminate rejection of sub assemblies due to faulty components. Save re-work time . . . reduce manufacturing costs.

PACKING OPERATIONS . . . TOTA TRAY Conveyors save time and money in the packaging of all types of variety-packs. Empty containers are filled as they pass each work station. TOTA TRAY Conveyors can also be utilized to carry products. For selective order-picking, the desired products are picked off and packed for shipment as the conveyor moves past each station.

GET THE FACTS

. . . write for complete information . . . request your free copy of Catalog No. A-580.

R W **Richards-Wilcox**

MANUFACTURING COMPANY

MATERIALS HANDLING DIVISION

410 W. THIRD ST. AURORA, ILL. Branches in all Principal Cities

For more facts Circle 422 on Reader Service Card

What is your cost-cutting I.Q.?

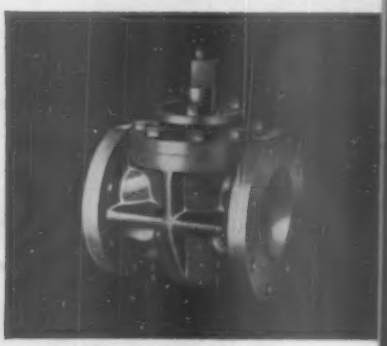
Do you know these nine products commonly used in industry to cut costs and increase manufacturing profits? They provide the records and controls you need to prevent waste, to improve your end products or to do both.

Rockwell as the world's largest single manufacturer of meters, regulators and valves has a world of experience upon which you can call. Wherever liquids, gas or air flow through pipes in your plant our experience can help you save money.

It costs nothing to get the facts—simply send the coupon.

THIS IS A ROCKWELL
LARGE CAPACITY GAS METER
You can use these meters with profit to spot furnace inefficiencies and prevent fuel from being wasted. Your accountants will welcome the cost records these meters provide for their in-plant controls.

THIS IS A ROCKWELL LIQUID METER
WITH AUTOMATIC SHUT-OFF
This meter-control system will save money for you who batch or blend liquids. It will precisely control your formulas, prevent contamination and can be preset to shut-off automatically.



THIS IS A ROCKWELL
PERMATURN® VALVE
This new valve line can reduce costs in your plant. Permaturn valves offer long trouble-free life in *all* services, easy o tough. They open or shut with a quick quarter turn of a wrench.

ROCKWELL

The leading single source for Measurement / Control products and ideas

SEND
THE COUPON
NOW!

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THIS IS A ROCKWELL
CONSUMPTION TEST GAS METER

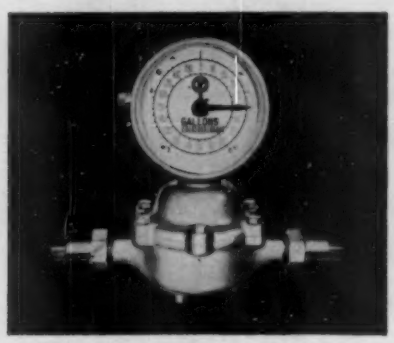
If you make gas appliances, this meter will save you time and money in adjusting burners to the most economical and efficient flow rate. You can also use it in your laboratory.

THIS IS A ROCKWELL
GAS PRESSURE REGULATOR

With this regulator you'll save fuel and improve the quality of products fired in furnaces and kilns. It maintains burner pressures at a uniform level, prevents erratic flaming.

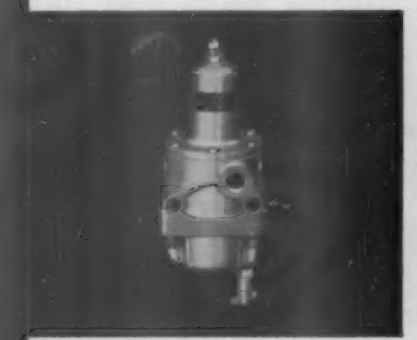
THIS IS A ROCKWELL
"SERIES 205" RECORDER

This clock driven gauge provides chart records of pressure, temperature or both. It's available with single or double pens. You can use it profitably to spot inefficiencies or for process control.



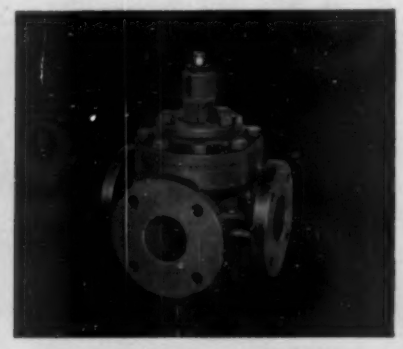
THIS IS A ROCKWELL
LOW COST LIQUID METER

This all-bronze meter will measure 207 different liquids. It costs very little, will handle up to 95% of all your in-plant meter needs. With it you'll save by gaining accurate records of piped liquids.



THIS IS A ROCKWELL
COMBINATION FILTER-REGULATOR

This product assures a clean supply of air or gas delivered at a constant pressure to pneumatic systems, instruments, paint spray units, air chucks, etc. You'll save on first cost and through it ease of maintenance.



THIS IS A ROCKWELL MULTIPORT
PERMATURN VALVE (3-way or 4-way)

Multiport valves offer you marked savings on many installations. One 3-way or 4-way multiport can frequently be used in place of two, three or four straightway valves and also eliminate other fittings such as tees and elbows.

INTERESTED IN HOW MUCH YOU CAN SAVE?

There is hardly a plant of any kind — including yours — where the right application of the right measurement and control methods and equipment won't produce substantial savings. It will cost you nothing to find out. Just talk to an experienced Rockwell field engineer. Let him explore new approaches to cost cutting through measurement and control. There's no obligation and perhaps a lot to gain. Just mail the coupon. Rockwell Manufacturing Company, Dept. MCIM, Pittsburgh 8, Pa. In Canada, Rockwell Manufacturing Company of Canada Ltd., Box 420, Guelph, Ontario.

MEASUREMENT AND CONTROL DEVICES

fine products by

ROCKWELL

Rockwell Manufacturing Company
Dept. MCIM, Pittsburgh 8, Pa.

- ☐ Please have your field engineer call.

Send literature as checked:

- ☐ Valving gas, liquids and slurries, Bulletin V-612
- ☐ Recording pressures, temperatures, Bulletin 17
- ☐ Regulating gas/air pressures, Bulletins 1044, 1059, 1082, 1086
- ☐ Metering liquids, Bulletins P-100, PI-666, OG-400
- ☐ Condensed catalog of all products, Bulletin C-5000

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Company_____

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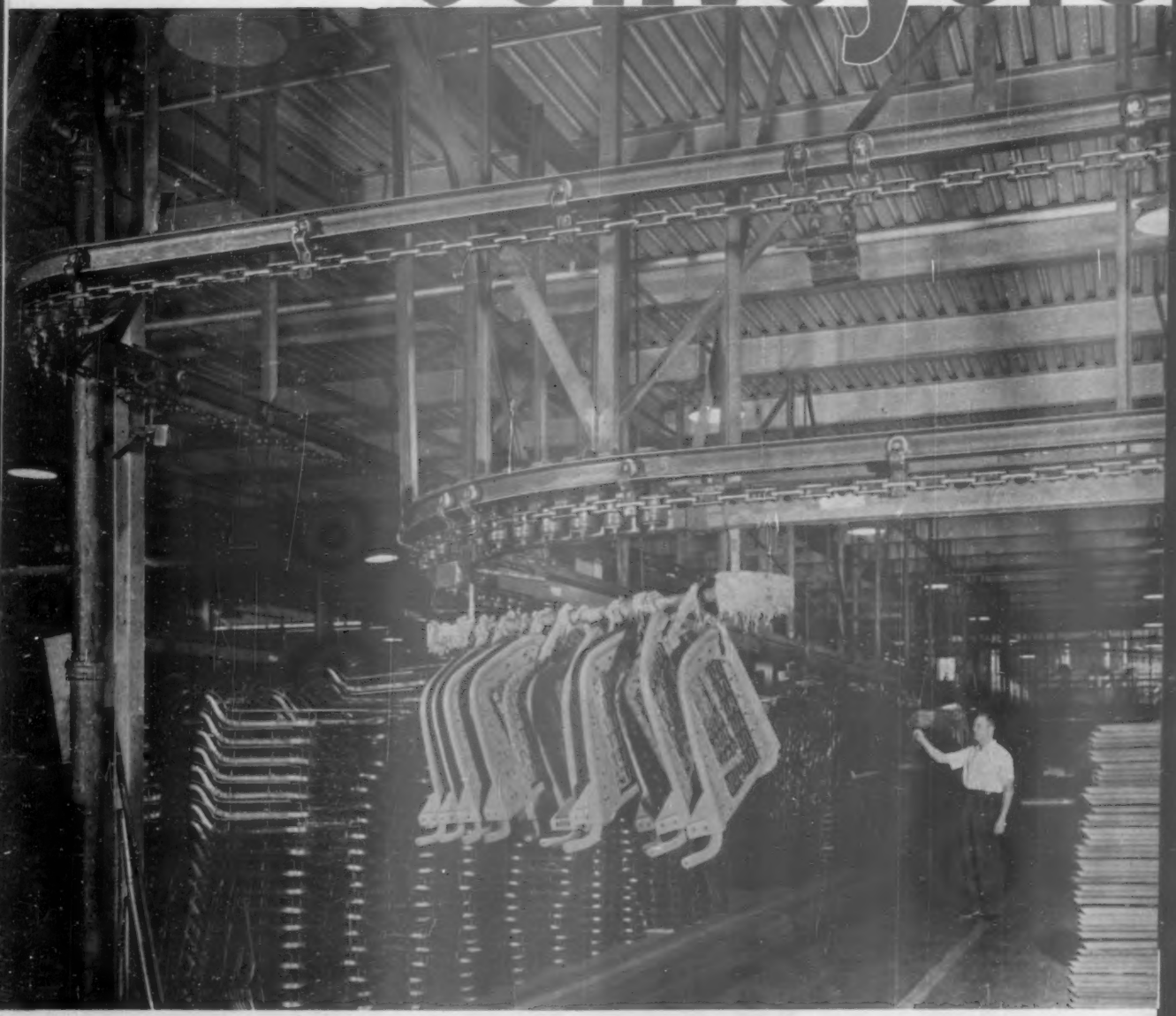
LINK-BELT conveyors



TROLLEY CONVEYORS—Link-Belt can provide systems to carry item of all sizes and shapes . . . to travel any path. Handling individua components or finished products, trolley conveyors or power-and-fre trolley conveyor systems provide straightline production for operation separated by a few hundred feet or several miles.

The last word in value from the first name in conveyors

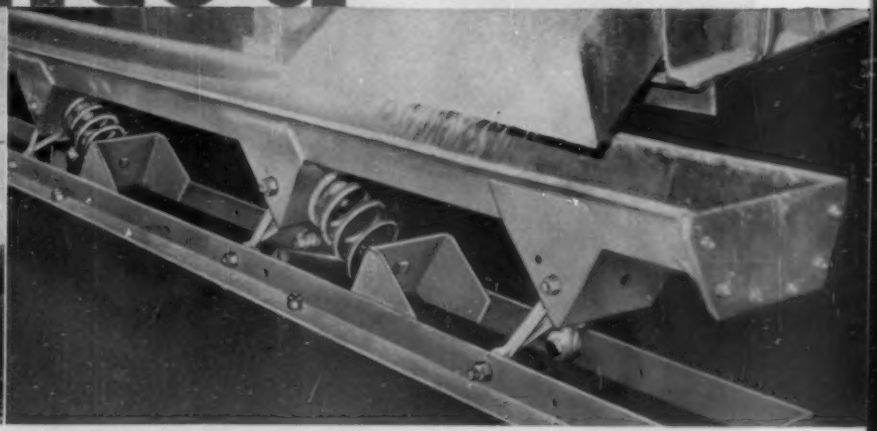
When it comes to your materials handling needs, it is a matter of sound economics to depend on Link-Belt, builders of industry's most complete conveyor line. In addition to this broad range of line, which permits unbiased recommendations, Link-Belt offers *quality*—achieved through engineering skills, manufacturing scope and research . . . *"experience unlimited"* in the materials handling field.

Also important, Link-Belt can provide *complete* handling systems . . . patterned exactly to your requirements with a background of more than 80 years of conveyor specialization Our engineers are familiar with the particular handling need of every industry. It's more than likely they have met—an solved—many problems similar to yours. We will desig equip and erect your entire installation . . . and accept fu responsibility for its successful operation.

For full information—on single components or complete sy tems—large or small—contact your nearest Link-Belt offic Catalogs covering all conveyors are available on request.

unlimited

The line that means savings, whether handling parts or bulk materials, finished products or units



UCKET ELEVATORS—Unlimited solutions to vertical r inclined movement of a wide variety of materials -bulk or parts. Fourteen types in four basic designs e fabricated from Link-Belt designed and integrated mponents—factory aligned for low-cost installaon, smooth performance.

OSCILLATING CONVEYORS—Whether handling fines or granules, chunks, parts or metal chips, Link-Belt's four types of oscillating conveyors—Flexmount, Coilmount, Heavy-duty Coilmount or Torqmount—provide surge-free movement of materials. All types feature *full-time positive action*, yet operate as near to *natural frequency* as possible to minimize power requirements.

ELT CONVEYORS—Link-Belt serves as a single source for design, equipment and erecon of *Job-Engineered* belt conveyors for large tonnages, for routes of any length. ink-Belt engineers have the selection advantage of industry's most comprehensive ler line—plus a broad range of pulleys, drives, terminal machinery and auxiliary uipment. Husky, *Pre-Bilt* sectional belt conveyors are also available from Link-Belt.

SCREW CONVEYORS—Easily adapted to congested locations . . . operate horizontally, vertically or inclined. Link-Belt provides all components for a complete screw conveyor line. Exclusive optional *Quik-Link* feature permits fast, easy removal of any conveyor section without disturbing other components.

LINK-BELT

CONVEYING AND ELEVATING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World. 15,577

Keeping production on the move in every industry

- Apron conveyors
- Arm and tray elevators
- Belt conveyors
- Bucket elevators
- Bucket elevators-conveyors
- Bulk-Flo
- Car-type conveyors
- Chain conveyors
- Circular carrier conveyors
- Drag conveyors
- Flight conveyors
- Flite-Flo conveyors
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- Power-and-free conveyors
- Pusher chain conveyors
- Scraper conveyors
- Screw conveyors
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- Skip hoists
- Slat conveyors
- Trolley conveyors
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6" Vertical Grinder.

7" Vertical Sander.

6" Straight Grinder.

8" Straight Grinder.

NEW CP air-operated GRINDERS AND SANDERS

knock the high spots off grinding and finishing costs

High torque "Power Vane" motors deliver the power reserve that lets operators lay into tough hogging or snagging jobs. Speed sag is kept to a minimum so that every job gets done quickly and safely.

CP Grinders deserve their industry-wide reputation of cutting metal removal costs on every job. The compact, lightweight housings provide the handling ease for every metal finishing operation.

CP GRINDERS AND SANDERS GIVE YOU ALL THESE FEATURES:

- **30 MODELS TO CHOOSE FROM**
- **NEW LIGHTWEIGHT, HIGH TORQUE MODELS**
- **EFFECTIVE ACOUSTICAL SILENCING**
- **UNIVERSAL, HICYCLE, SUPER CYCLE ELECTRIC GRINDERS AND SANDERS**

The CP line includes: Straight and Vertical Grinders; Die Grinders; Small Wheel Grinders; Belt Grinders; Polishers and Sanders. For full details write:
Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.

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ELECTRIC TOOLS • PNEUMATIC TOOLS • AIR COMPRESSORS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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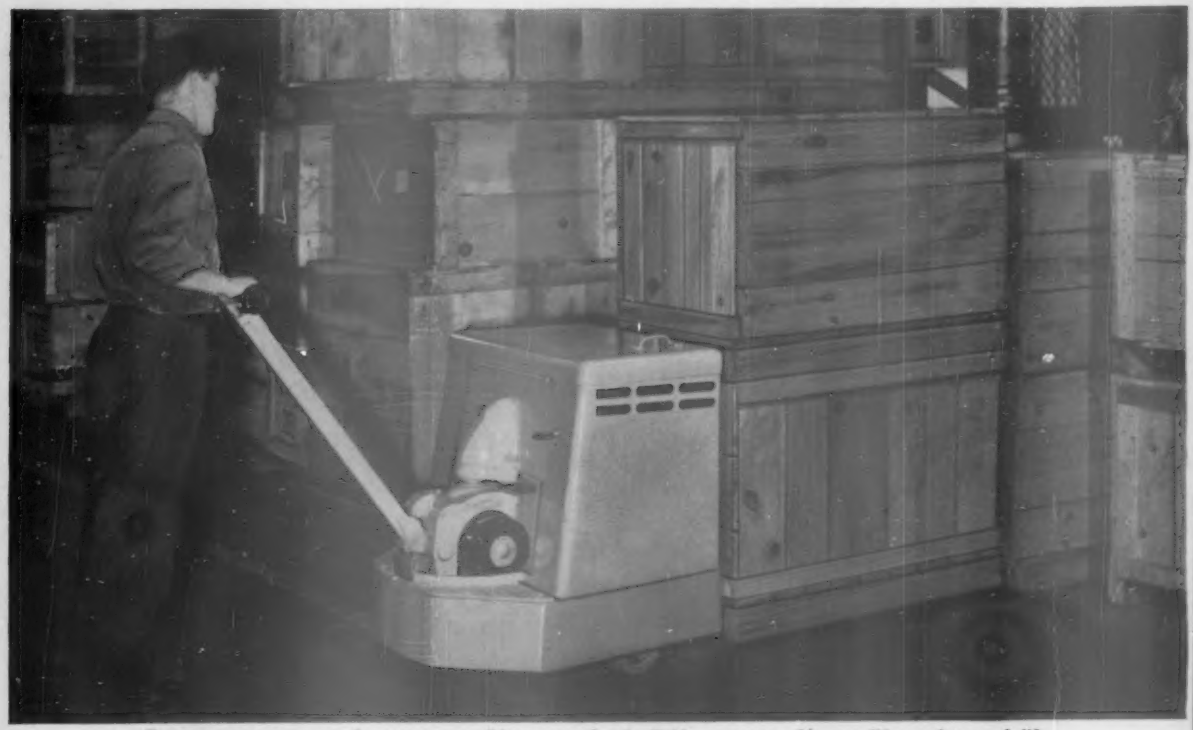
EXIDE POWER PACKAGE

Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

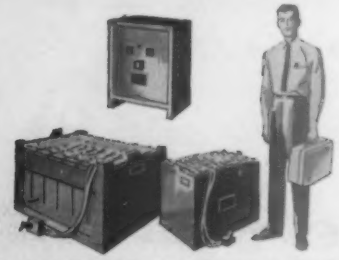


Extra economy assurance for your new walkie-type truck—the Exide guarantee of battery life equal to truck life.

BATTERY GUARANTEED FOR LIFE OF TRUCK

Let's say you're about to buy a new walkie-type electric industrial truck. You want long battery life for maximum economy, and you don't want the nuisance of ever replacing the battery, if you can avoid it. Well, this is the Exide offer:

For walkie-type low lift trucks and hand tractors, the recommended Exide nickel-iron-alkaline battery (the type invented by Thomas A. Edison) is guaranteed for the life of the truck—provided the truck remains in your possession and approved maintenance procedures are followed.



The Exide Power Package. Recommended battery and charger from the world's broadest lines—plus factory-quality service to cover both.

This is not a reckless offer. Exide knows from countless actual performance records that these batteries readily give this kind of life. Many Exide nickel-iron-alkaline batteries have been used in walkie-truck service for upwards of 20 years and are still going strong. So the plain fact is that we are simply giving you positive assurance of battery value that is already there anyway.

Long life is one of the characteristics of Exide nickel-iron-alkaline batteries. They have other unique advantages too. They are lighter in weight than other batteries. They give off no corrosive fumes during use or while charging. And they can be stored indefinitely without injury. This is of special value during seasonal shutdowns or other inactive periods. All you do is discharge the battery, short-circuit the terminals and store in a clean, dry place.

Of course, for any type electric industrial truck—walkie, rider, or narrow-aisle—the maximum power economy depends on three factors: the right battery for the job, a charger to match, and needed service. This combination is the Exide Power Package.

Your Exide representative studies your requirements, then recommends the battery best for your needs from the broad Exide line. He is completely objective in determining your needs because Exide offers all types: Exide-Ironclad with tubular positive plates, Exide-Powerclad premium flat-plate, and Exide nickel-iron-alkaline. Exide chargers are available in both motor-generator and silicon rectifier types and in sizes to cover all needs. Exide service men are coast to coast, all factory trained on batteries and chargers.

The Exide Power Package is your easiest way to get not only maximum battery life in your applications, but maximum battery economy year after year. Write for details. Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Exide®

NEW
TWO-HIGH
SPACE MAKER
HIGH-VOLTAGE
CONTROLLER

SpaceMaker is an Allis-Chalmers trademark.

the only real drawout 2- to 5-kv controller...with a contactor you can get at, into, around...without tools

▲ This means no unbolting—no wires to unfasten. You rack the contactor to "disconnect position" with the door closed. Open door. Roll contactor carriage out. It's that simple, that quick . . . and safe. ● Inspection? Lift out arc chutes and barriers. Rotate pole pieces to fully expose contact structure. Fuses? Lift them out, too. No tools, all the way. ■ SPACEMAKER control. First dramatic new achievement in high-voltage motor control in more than a decade. To learn more about the many cost-cutting features, call your A-C distributor or representative. Or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

LET'S COMPARE THESE FEATURES

	SpaceMaker Controller	Controller "A"	Controller "B"
Two starters in 90" height	Yes	No	No
Drawout construction	Complete	Partial	No
Simultaneously disconnects all six main leads (line and load)	Yes	Line Only	Line Only
Automatic shutters isolate line	Yes	Yes	No
"No-tool" inspection of contacts	Yes	No	No
Track-resistant, flame-retardant insulation	Yes	No	No
Contactor construction	Double Break	Single Break	Single Break
Overload relays visible from outside	Yes	No	No

ALLIS-CHALMERS

A-1521

VARI-TEX speed changers: sum features!

...WHILE OTHER SPEED CHANGERS HAVE ONLY SOME FEATURES, VARI-TEX UNITS OFFER ALL THE CHARACTERISTICS THAT ADD UP TO EXTRA EFFICIENCY, EXTRA DEPENDABILITY, TOTAL VALUE.

This speed changer has a few tricks up its sheaves. More than any other motorized speed changer. More advanced features that add up to *lower costs.*

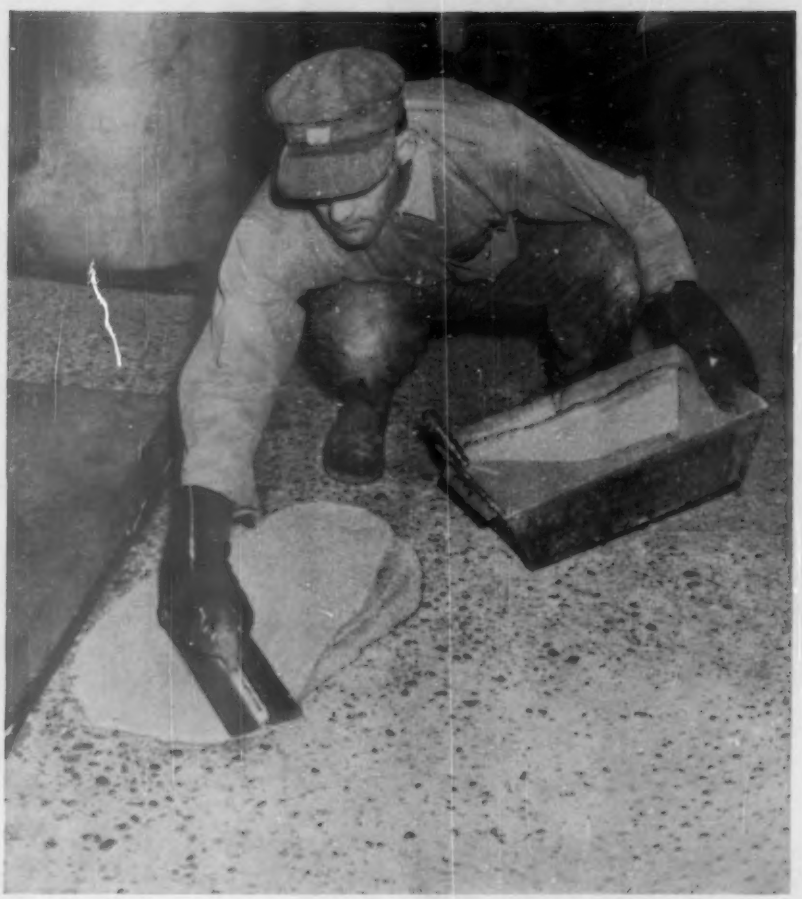
No other speed changer is so easy to maintain. Belt changes are quick and simple . . . thanks to larger case openings. Lubrication? Easier still. You don't have to remove end housings or coverplates to get at the fittings.

Vari-Tex units save space, conserve input horsepower. They're available in vertical, horizontal or 45° mounting configurations. With single, double or triple reduction gear units. And there's one "extra" that's free with every unit — Allis-Chalmers *experience.*

See your A-C representative or nearby distributor. Or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. A-1547

Vari-Tex is an Allis-Chalmers trademark.

ALLIS-CHALMERS



LEADING PLANTS CUT COSTS

by resurfacing floors with Penntrowel®

You'll find Penntrowel floor surfacing installations in plants across the nation. There are corrosion-resistant resinous Penntrowel cements . . . Penntrowel Flextherm, in red, green and neutral, for floors subject to thermal shock . . . Penntrowel Floor Surfacer for heavy vehicle traffic . . . Penntrowel Latex, a cement-latex mixture for a tough, resilient surface—interior or exterior application . . . and special Penntrowel for fluoride service.

Whichever grade you choose, you can be sure of simple, economical installation, long wear, minimum maintenance. Penntrowel materials bond easily to concrete, brick and metals. Applied by trowel or by new high-speed spray equipment, they require only a clean, sound sub-surface, and cure quickly at room temperature. Most installations call for a topping of only ¼-½ inch thick . . . saving material, labor and weight.

Here are a few of the plants where floors are protected by PENNTROWEL:

C & D Batteries
Conshohocken, Pa.

Dairy Cooperative Assoc., Mayflower Brand
Portland, Oregon

The Dow Chemical Company
Midland, Michigan

Freeport Sulphur Company
Port Sulphur, La.

B. F. Goodrich Chemical Co.
Avon Lake, Ohio

Granite City Steel Co.
Granite City, Ill.

H. J. Heinz Co.
Pittsburgh, Pa.

Hudson Coop Dairy Assoc.
Hudson, Iowa

Jones and Laughlin Steel Corp.
Pittsburgh, Pa.

Mallinckrodt Chemical Works
Jersey City, N. J.

Mallinckrodt Chemical Works
St. Louis, Mo.

Mead Corporation
Chillicothe, Ohio

Mohasco Industries Inc.
Greenville, Miss.

National Lead Co.
Cincinnati, Ohio

National Steel Corp., Midwest Steel Div.
Portage, Indiana

Pittsburgh Plate Glass Co.
Cumberland, Md.

Pittsburgh Plate Glass Co., Chemical Div.
Natrium, W. Va.

Russell Burdsall & Ward Bolt & Nut Co.
Coraopolis, Pa.
Rock Falls, Ill.

Utah Wool Pulling Co.
Salt Lake City, Utah

Penntrowel—
Rugged as a Rhino

Write for complete information on Penntrowel floor surfacing materials.

PENNSALT CHEMICALS CORPORATION
Corrosion Engineering Products Dept. • Natrona, Pa.
Manufactured in Canada by G. F. Sterne & Sons, Ltd., Brantford, Ontario

Pennsalt Chemicals®
ESTABLISHED 1850

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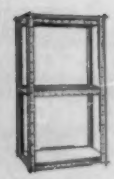
IT'S ONE OF OVER 250 NEW ACME

PRE-CUT, READY-TO-ASSEMBLE SHOP EQUIPMENT, IN MOST NEEDED STYLES AND SIZES. Why pay a premium for shop equipment? Why settle for *almost right* design and dimension? Build it yourself from first-of-their-kind kits of Acme Steel's AIM Brand Slotted Angle. Just open the package, grab a wrench—and *go*. Anyone can bolt together tailored-to-the-task storage units, racks, carts, tables and benches. Each package brings you the strength, stability and assembly ease of AIM Brand Slotted Angle . . . but with the added convenience of pre-cut pieces. Everything's there: nuts, bolts, accessories, instructions. And, if your working

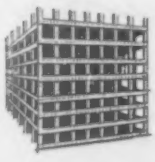

Customized storage units cost no more.

Eighteen sizes of flat bed carts.

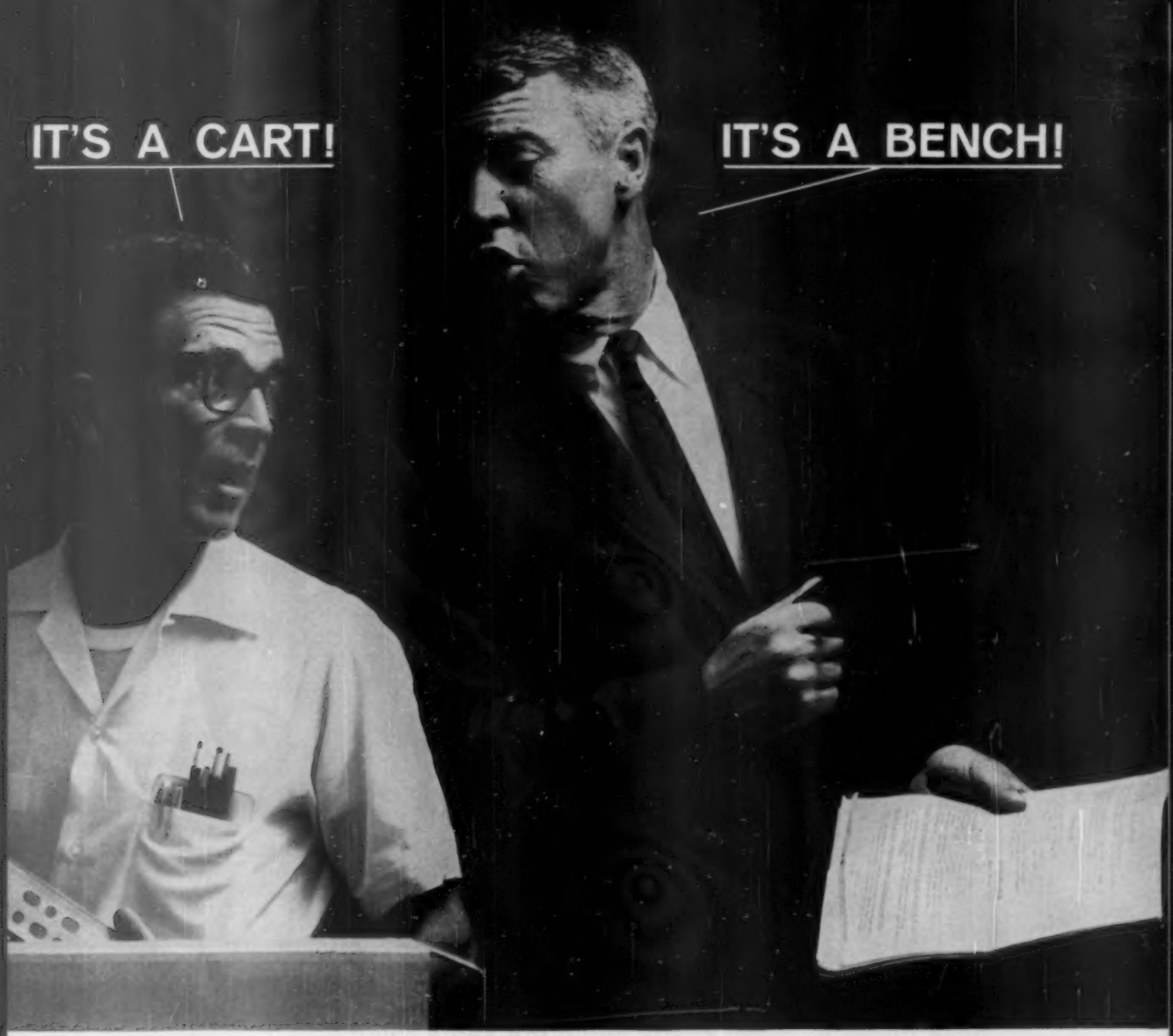
Need sturdy steel-topped tables?

How many of your foremen need a desk?

Store bars and tubes in less space.


Cube type bar racks come in 48 sizes.

Rack your sheet stock at low, low cost.



STEEL SLOTTED ANGLE KITS . . .

requirements change, so can this galvanized steel framing. It can be adjusted to modify design, dismantled and reused for other jobs. You never have to discard it.

If you have yet to experience the time, material and manpower savings of slotted angle construction, you can now at minimum investment. Your local AIM Brand distributor has full facts. He's in the Yellow Pages under "SHELVING" or "RACKS." Like to see slotted angle in action? Write for our new 24 page idea book, "Creative Framing at Lowest Cost": Fabricated Materials Division, Acme Steel Company, Dept. FACP-121, 135th St. & Perry Ave., Chicago 27, Ill.

ACME STEEL

IDEA LEADER IN

FRAMING - STRAPPING - STITCHING

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You're right that Magnaflux and Nondestructive Testing (NDT) have come to mean pretty much the same thing over the last 30-plus years . . .

. . . MAGNAFLUX OFFERS YOU MUCH MORE THAN TESTING SYSTEMS AND METHODS

TAKE R&D. Right now you may be planning a new component—for a missile, an airplane, a motor car. Is it a good design, can you produce it economically? Will it work—or be a million dollar failure? How can you be sure? How can you test it?

The people at Magnaflux can help you find out . . . *in advance.* Our R & D will work with yours in Application Studies, or contract to take over specific parts of the problem. This could be included as part of your own development cost. You'll free many of your own key people for other assignments. You'll put a variety of specialists on your payroll—*but only when you need them.*

YOUR PRODUCT ISN'T YET IN THE DESIGN STAGE? You could use some help at basic levels—metallurgical, chemical and physical testing—alloy recommendations—metallographic studies—fatigue evaluation—environmental tests? No problem here! METAL CONTROL LABORATORIES, Huntington Park, California—now part of Magnaflux—has been supplying just such assistance for years. This is worth checking into—you'll have one of the finest materials engineering and specialized testing laboratories in the world assisting you. The cost? Usually far less than you'd spend to approximate their results—*if you had the facilities.*

YOUR NDT NEEDS ARE NATIONWIDE? So are Magnaflux facilities. MAGNAFLUX MATERIALS TESTING LABORATORIES are so widely used, all around the country, many people think they are part of a separate company. Not so! This is a part of Magnaflux Corporation, set up to serve you either of two ways: You bring your test needs to our Lab or we come to you with fully-equipped Mobile Labs . . . in your plant or out in the field—airport, overhaul plant, oil rig, bridge, wherever you need it.

MTL provides all the Test Systems of Magnaflux—including radiography, magnetic field measure, others. Further, since the service is nationwide, every laboratory can help every other, whatever your need. This is a real pool of equipment and men. Principal enthusiasts are airlines, missile and aircraft producers—plus a hundred or so major industrial plants—for maintenance and production.

YOU NEED YOUR OWN TEST SYSTEMS? Then, of course, you aren't thinking just of hardware. Many Magnaflux Test Systems are available or readily adaptable to do your test job. Such Systems are testing, for instance, critical tubing that may go into orbit around the earth—finding any defects in million-run bearing cages—testing rocket motor solid fuel chambers—and steel billets 40 feet long, 10 inches square—air frames, jet engines—with push button or automatic handling.

Full-scale, super-efficient Test Systems like these come about when responsible people plan NDT as part of R & D, engineering and production. It's best to do it early—at the first concept stage, if possible. Then everything programs out—design, production, testing.

Testing becomes, as it should, a part of product planning. We call this "system engineering". It goes far beyond too many common ideas of "testing". It's not something done because you must, but because it saves money, keeps the product true to its purpose—not just to meet specifications but to work and operate as it should.

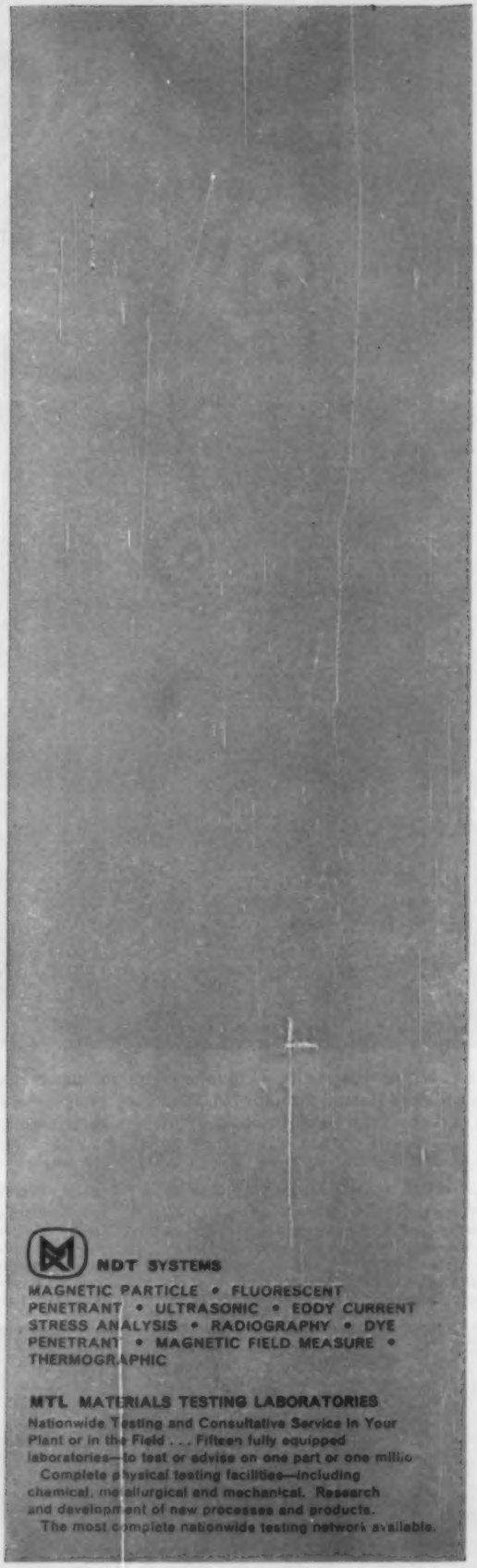
Providing the experience, understanding and men is a Magnaflux function that goes well beyond the limits often thought of as "testing". HOW CAN YOU USE SUCH HELP BEST? Quickest way to find out is to call your Magnaflux Field Engineer—or write Magnaflux Corporation, 7316 West Lawrence Avenue, Chicago 31, Illinois.

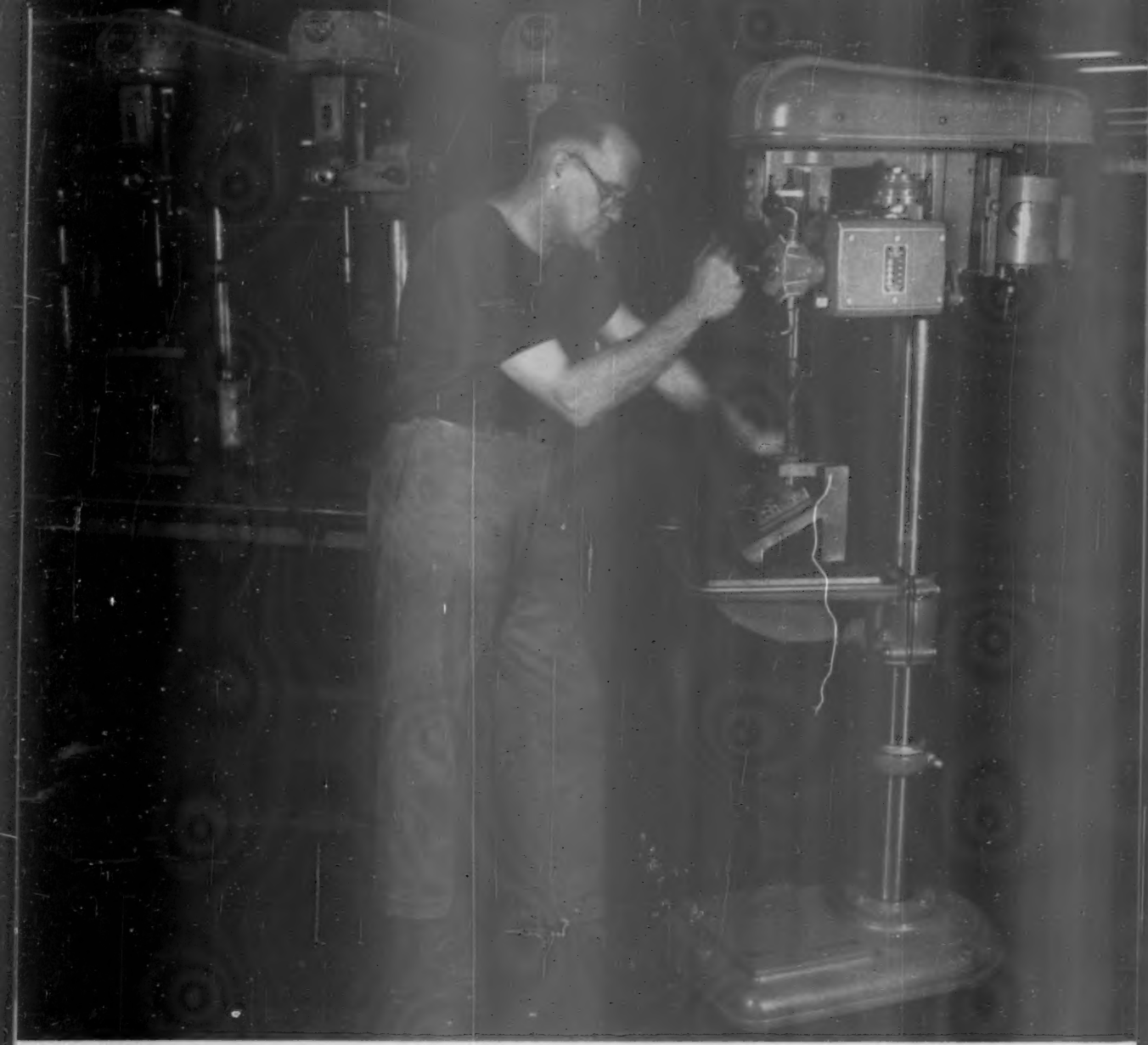
MAGNAFLUX CORPORATION

TEST SYSTEMS

A SUBSIDIARY OF GENERAL MILLS

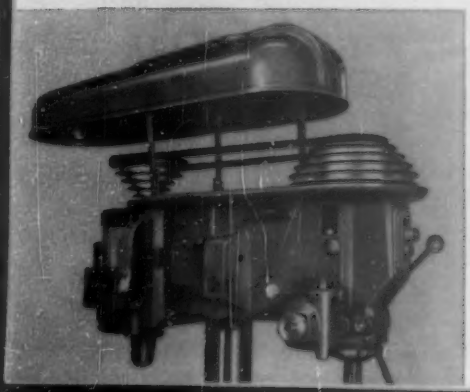
General Mills


NDT SYSTEMS
MAGNETIC PARTICLE • FLUORESCENT PENETRANT • ULTRASONIC • EDDY CURRENT STRESS ANALYSIS • RADIOGRAPHY • DYE PENETRANT • MAGNETIC FIELD MEASURE • THERMOGRAPHIC
MTL MATERIALS TESTING LABORATORIES
Nationwide Testing and Consultative Service In Your Plant or in the Field . . . Fifteen fully equipped laboratories—to test or advise on one part or one millio
Complete physical testing facilities—including chemical, metallurgical and mechanical. Research and development of new processes and products.
The most complete nationwide testing network available.

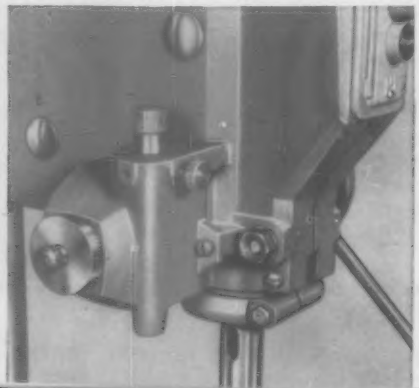


ALL NEW Capacity—Equipped with exclusive Rockwell Power Feed (tested through 750,000 drilling cycles) the all new 17″ drill presses handle many production jobs ordinarily done by costly, fixed equipment. In addition, they offer portability that can be utilized to perform extra drilling operations on limited runs or to relieve production line bottlenecks.

ALL NEW Interference-free Guard—Tilts up and back out of the way giving operator plenty of room to make belt and speed changes quickly, easily. Three specially designed supports and a stop hold steel guard in "up" position, built-in clips automatically lock guard in operating position when closed.



ALL NEW Internal Depth Stop Mechanism—A new concept in depth stops that eliminates bottom-of-stroke quill deflection which causes excessive drill breakage and downtime. Convenient adjustment knob permits fast, one hand operation, locks in position to stop pinion shaft at same depth through repeated cycles.



ALL NEW Pivot-type Motor Mount—Assures full release of belt tension before changing from one pulley speed to another, delivers longer belt life and eliminates possibility of damage to the belt. Maintenance of proper running tension on belt at all times prevents undue wear on bearings.

You can do more with these

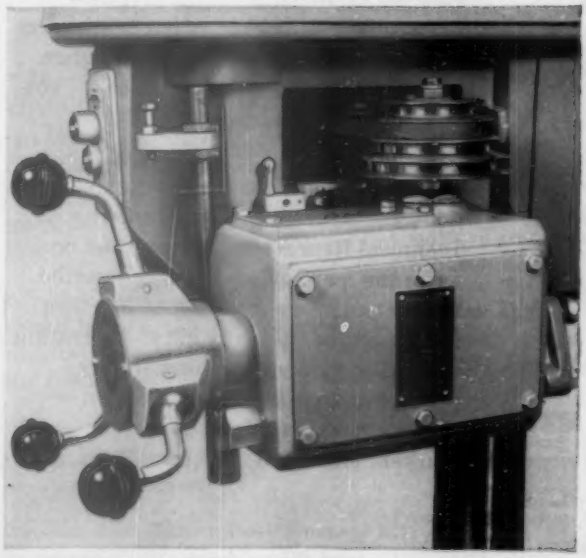
ALL NEW DELTA 17" DRILL PRESSES

Here is a major engineering advance from Delta to give you increased drilling accuracy, more job flexibility and greater operating economy. You can choose the machine best suited to your needs from 76 models in a complete line of 17" drill presses that incorporate the most up-to-date performance features available.

These drill presses are completely new—not merely improved or re-styled—but actually re-designed to deliver consistent precision operation under the most rugged work loads with little or no maintenance.

With the introduction of this all new 17" drill press line, Delta continues to provide the high quality of product that has made it the leading name in drill presses for over 31 years. Your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) will gladly demonstrate how these 17's can save you dollars, hours and material. Why not call or see him soon!

FREE BROCHURE—Complete specifications and details on the full line of all new 17" drill presses and accessories. Simply write: Rockwell Manufacturing Company, Delta Power Tool Division, 628M N. Lexington Ave., Pittsburgh 8, Pennsylvania.



ALL NEW Rockwell Power Feed—Available as original equipment or as an accessory on every model, this advanced development in mechanical power feeds gives you: a front mounted pilot wheel for one hand operation and "flick of the wrist" control of feeding; infinitely adjustable drill point pressure and a built-in feature that permits remote control. For semi or fully automated operations, power feed can be electrically, hydraulically, pneumatically or mechanically interlocked with other machines.

CHOOSE FROM 76 MODELS

Selection includes: floor, bench or multiple spindle machines equipped with standard or production table, standard or Rockwell Power Feed, key chuck or tapered spindle, high or slow speed.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

For more facts Circle 431 on Reader Service Card

IF YOU BUY THESE
TO IDENTIFY
YOUR PRODUCT

New folder illustrates examples from every industry of profitable, effective product and package identification by Markem machines. Write for your free copy.

. . . MAKING YOUR OWN LABELS
or DIRECT PRODUCTION MARKING
may save you
thousands of dollars
and delays every year

Using labels, decals, transfers, tickets, tags, nameplates or handstamps to identify or decorate your products and packages may mean spending far more money and time than you need — and getting less than perfect product and package identification. In contrast, consider these natural advantages of *making your own labels* or *direct marking* as needed with a flexible, efficient production machine in your *own* plant:

. . . you automatically identify or decorate *as production requires*, with *complete* information in a *single* low cost label or direct print

. . . you cut your *investment* in label inventory . . . and eliminate waste from obsolescence

. . . you achieve *attractive and completely informative* product and package identification . . . that helps the buyer, the user, and the person who reorders

. . . you're *independent of outside sources* and you avoid inconvenience when new identification is needed . . . you can change part or all of the imprint in seconds

To get specific cost-saving recommendations and figures, call the Markem Technical Representative near you or write the main office. We will describe the particular combination of Markem machine, type, specialty ink and operating method to give you highest quality product and package identification — at the *lowest possible cost.*
Markem Machine Co., Keene 18, N. H.

MARKEM
HELPS YOUR PRODUCT SPEAK FOR ITSELF

For more facts Circle 432 on Reader Service Card

Cat Wheel Loaders prove themselves on the job

WHEREVER THEY WORK—WHATEVER THEY DO...CAT WHEEL LOADERS ARE GETTING THE WORK DONE QUICKLY, ECONOMICALLY, SAFELY

Broad River Brick Co., Gaffney, S. C.—Cat 944 Wheel Loader scoops up a full bucket of brick clay for hopper charging. "Our 944 is fast, maneuverable and easy to operate," reports the assistant plant manager, who measures machine features in terms of daily performance...and is well satisfied.

Great Western Sugar Co., Scottsbluff, Nebraska, uses a Cat 966 to truck-load stockpiled beets for processing at the local plant. With a special 6-yd. bucket, the big Caterpillar 966 loads 1500 tons of beets daily from various stockpiles over the Scottsbluff Valley.

• Three Sizes: 922 – 80 flywheel HP (105 HP max.), choice of gasoline or Cat Diesel Engine; 944—105 flywheel HP (135 HP max.), choice of gasoline or Cat Diesel Engine; 966—140 flywheel HP (205 HP max.), Cat Diesel Power.

• Bucket Sizes from 1¼-2¾ yd. with special buckets, including side dump, and forks always available from the Cat Dealer.

• Power Shift Transmission – fast response, smooth on-the-go shifting at the touch of a finger.

• Automatic Bucket Positioners—speed cycles. One touch on lift lever raises full bucket to dumping height and *holds* it. Another touch on tilt lever automatically positions bucket at the correct digging angle. Operator is free to maneuver loader.

• Easy On-and-Off Design – operator mounts machine via three steps. He sits *behind* the lift arms and has visibility all around. This safety gives him confidence, speeds the work.

• Diesel Fuel Range—Cat Diesels use the heavier, lower-cost, high-energy No. 2 furnace oil – as well as the premium grades.

• Live-Action Hydraulics – for fast-acting bucket and lift movements with high lift capacity. Pump is driven direct from engine, keeps hydraulics fast regardless of load on drive wheels.

• All-Weather Starting – with independent gasoline starting engine available on all diesel models. Direct electric key starting is standard.

• Dual Braking – one brake neutralizes the transmission as it stops the machine, transferring extra power to the bucket, assuring full loads in tough material. Right brake pedal stops machine with transmission engaged... for full control.

Your Caterpillar Dealer will gladly show you these machines, their many features and how they can be tailored to your needs. See him soon. Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

For more facts Circle 433 on Reader Service Card

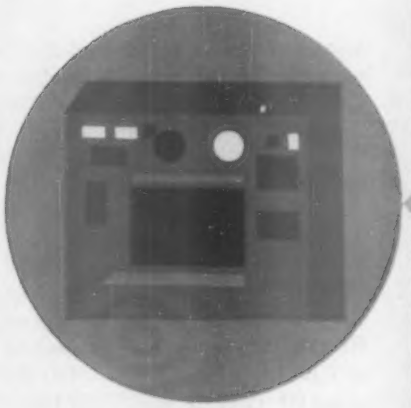
new electronic order processing drastically reduces your electrical apparatus renewal parts inventory

1

Customer phones or mails his order for renewal parts to his local Westinghouse sales office.

3

A computer in the Pittsburgh order processing center determines that the order can be filled from the Westinghouse warehouse which regularly serves the customer and transmits the required information to that warehouse. The teletype receiver in that warehouse goes into action and produces all shipping forms.*



*If the nearest warehouse inventory records show insufficient stock, the computer would review—immediately and automatically—the inventory of other nearby warehouses which could ship. Then shipping information would be teletyped to the closest warehouse with stock and shipment would be made from there—all within the same 30 minutes.

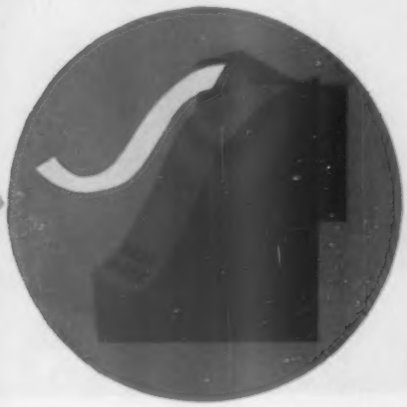
J-95221

The new Westinghouse automatic order processing system puts every renewal parts order on the shipping platform . . . on its way to you . . . in 30 minutes.

This fantastically fast, accurate service is made possible by linking the Westinghouse teletype network . . . the world's largest industrial network . . . with an Electronic Data Processing installation in Pittsburgh. This automatic system compresses days into minutes. This new service, coupled with constantly improving rail, truck and air freight schedules, enables you to attain production and inventory efficiencies in your maintenance parts stocks that . . . up to now . . . you could only wish for.

With this new concept in distribution, you can reduce capital investment in renewal parts and help eliminate production downtime.

Take advantage of this exclusive, 30-minute order handling system for all your renewal parts requirements. Call your local Westinghouse sales engineer to place your next order . . . prove to yourself how quickly you can replenish your stocks with Westinghouse quality renewal parts. *You can be sure . . . if it's Westinghouse*



2

A teletype operator in the local Westinghouse office puts the order into code form on a paper tape which transmits it to the order processing center in Pittsburgh.

4

A warehouseman matches the teletyped forms to the proper part in stock and puts the order on the dock for delivery to the customer. An order placed anywhere in the country will be on the shipping dock within 30 minutes after it goes on the tape in Step 2. All paper work will have been done including automatic preparation of invoices for mailing to customer. All inventory records are automatically adjusted, even to ordering more of the item for the warehouse if stocks are low.

Westinghouse

For more facts Circle 434 on Reader Service Card

Diamonite® Products Mfg. Co., Shreve, Ohio, gang-grinds ceramic rings with natural diamond wheel. The unchanging dimension of the wheel assures uniformity of diameter and surface finish. Only diamonds can give the finish required to meet specified tolerances.

Bell & Howell, Chicago, grinds 13 lenses simultaneously with natural diamonds. Cup-type metal-bond wheel is impregnated with 160-mesh natural diamond particles. Bell & Howell also uses natural diamonds to polish precision parts for their new "zoom" camera mechanism.

These manufacturers are using natural diamonds to advantage. You can, too.

Industrial diamonds cut practically everything . . . especially your production costs

National Vulcanized Fiber Company, Wilmington, Delaware, cuts glass-reinforced plastic tubing with diamond cut-off wheel. Metal-bond diamond wheel withstands heavy abrasion of glass reinforcement, and leaves a clean, smooth edge without causing delaminations.

Kandu Tool Company, New Haven, Connecticut, grinds carbide gun drills, used to drill deep holes in steel, with natural diamond resinoid-bond wheel. In this operation, .015" of material is removed in a plunge cut. Only natural diamonds can withstand the impact of the interrupted cut.

The four grinding and polishing jobs shown here span the fields of optics, metalworking and ceramics. But they have one important thing in common: in every case, natural diamonds are doing the job quickly—and economically.

In diamonds, you find this unique combination of properties: excellent cutting ability linked with fantastic endurance.

Result: your diamond tools last longer than any other tools you can use. Your people spend more time producing, less time changing tools.

If you cut, sharpen or smooth in your business, you can probably use natural diamonds to advantage. Test them against the method you're now using. You'll see how efficient—and economical—a diamond can be, especially now.

BEST GRIT FOR METAL-BOND WHEELS DEVELOPED BY THE DIAMOND RESEARCH LABORATORY IN JOHANNESBURG

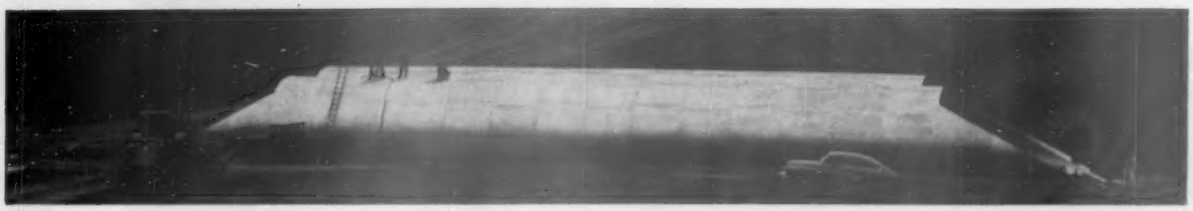
A new impact crushing method for natural diamonds is now producing the strongest and most durable diamond grit ever obtained for metal-bond wheels. Your tool and wheel manufacturer is ready to help you select the diamond tool that's right for your job.

Industrial Distributors (Sales), Ltd.
World's leading supplier of diamonds for industry

For more facts Circle 435 on Reader Service Card

New steels are born at Armco

Armco MULTI-PLATE Pipe Makes Economical Vehicular Underpass



View of construction site of twin underpass as erection crew bolts last plates of the MULTI-PLATE Structure.

Auto travels through completed MULTI-PLATE underpass while freight train, serving the coal mine, goes by overhead.

For strength, economy, durability — Steel

In constructing a railroad spur line to a new coal mine in Alabama, it was necessary to cross over a paved farm-to-market road. After careful consideration, owners of the mine decided on twin Armco MULTI-PLATE® Pipes for the two-way vehicular underpass.

An important factor was that corrugated metal MULTI-PLATE assured considerable savings over other types of bridging structures.

Each of the two lines of MULTI-PLATE Pipe was 17½ feet in nominal diameter, 168 feet long. Double railroad tracks are on a 32-foot wide roadbed, on top of the 25-foot fill.

Besides underpasses, industry uses MULTI-PLATE Structures for stream enclosures, access road bridges, and aggregate conveyor tunnels. Call your local Armco Sales Engineer for data on your specific needs, or write us for catalog. **Armco Drainage & Metal Products, Inc., subsidiary of Armco Steel Corporation, 6811 Curtis Street, Middletown, Ohio.**

ARMCO **Drainage & Metal Products**

For more facts Circle 436 on Reader Service Card

SQUARE D NORpak —A SIMPLER, FASTER, STATIC CONTROL!

NORpak is a significant advance in the field of static switching. Like other static systems, **NORpak** performs the functions of machine tool relays, stepping relays, latching relays and timers —all without contacts or motion of any kind.

Like other static systems, **NORpak** is ideal for applications where speed is important—where reliability and long life are essential—where conditions make conventional magnetic devices impractical.

But unlike other static switching systems, NORpak offers these important advantages

EASIEST TO APPLY

The transistor NOR unit is the basis of **NORpak.** All logic functions—AND, OR, NOT, MEMORY—can be accomplished with combinations of this single NOR unit.

NORpak is *not* complicated—it's easy to apply to conventional circuits. Units are color-coded for quick identification. Simple DC circuit eliminates worry about phase relationships.

UNMATCHED SPEED

NORpak provides switching at rates up to 25,000 per second—faster than any other industrial static system.

SMALLEST COMMERCIAL PACKAGES

NORpak is available in the form of individual components, or in completely engineered systems. Components are offered in 6 and 20 paks, require only 1/4th the equivalent relay panel space, and weigh less than components of other static systems.

EXTRA DEPENDABILITY

NOR units have been time-tested in computer use for years. They are not subject to wear, will give top performance indefinitely, and provide unfailing circuit fidelity.

SIMPLE TO USE

Optional monitor lights give visual evidence of proper performance. Simple dynamic sequence tester checks individual NOR units in operation.

EXPERT APPLICATION HELP

Field specialists, factory-trained in all aspects of **NORpak** can give you on-the-spot answers to any application questions.

NORpak is available as individual components for application to specific control functions, or as completely engineered systems ranging from the smallest to the largest panels

Write for the complete story on **NORpak** *—its theory, application and operation... Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin*

SQUARE D COMPANY

wherever electricity is distributed and controlled

For more facts Circle 437 on Reader Service Card

We've taken off our shine, too

Every National oil seal is now phosphate coated to inhibit rust

Other oil seals are still shiny. But look what National gives you in place of the gleam: an exclusive phosphate coating that improves rust resistance by "holding" rust-preventing lubricants to the seal's metal surfaces. The result is superior rust resistance on the shelf . . . *and on the shaft* where condensation is a constant peril to seal life.

This phosphate coating has another important advantage. It provides better adhesive properties and makes possible a more positive bond between metal retaining parts and Syntech rubber sealing members. This gives you a better seal with longer life.

Phosphate coating is just one of the "extras" in National seals. And with National you choose from a complete line with both Syntech rubber and Micro-Torc® leather seals in practically every type and size. When you need seals . . . get the best. Call your National Seal Distributor.

NATIONAL OIL SEALS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

For more facts Circle 438 on Reader Service Card

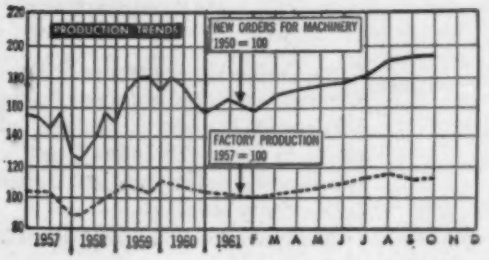
LOOKING AHEAD IN BUSINESS

A FACTORY PRESS TIME REPORT

FACTORY FIGURES OF THE MONTH

Indicator	OCT.[p] 1961	SEPT.[r] 1961	OCT. 1960
New Orders for Machinery (exc. elec.)[1]	194.0	192.0	166.0
Contracts for Industrial Construction[2]	130.0	105.0	192.0
Factory Production[3]	113.0	111.0	106.0
Consumers' Prices (cost of living)[4]	128.5	128.3	127.3
Industrial Prices (materials, supplies)[4]	128.0	127.5	128.0
Manufacturing Employment (millions)[4]	16.4	16.4	16.3
Total Employment (millions)[5]	66.7	66.3	66.4
Unemployment (millions)[5]	4.8	4.8	4.4

[p] = preliminary [r] = revised



Sources: 1. McGraw-Hill Dept. of Economics (1950 = 100); 2. Engineering News-Record (1950 = 100); 3. U. S. Federal Reserve Board (1957 = 100); 4. U. S. Dept. of Labor, Bureau of Labor Statistics (1947-49 = 100); 5. U. S. Dept. of Labor, Bureau of Labor Statistics.

Punchbowl predictions for 1962

THE OUTLOOK

Production and income should reach new highs next year, optimistic forecasters say. Consumers are expected to loosen their spending. Even the nagging unemployment problem will ease slightly.

Christmas is the time of year for wassailing and feasting. It is also the time for the annual business rite of taking stock of the year just finished and looking ahead to the coming year. Budgets are being drawn up, personnel requirements are being estimated, and capital additions and improvements are getting a close scrutiny. Based on this ritual, here is what is likely to happen next year on the business scene.

Production of mines, factories, and utilities will increase 10% to a high mark of 120 for the year on the Federal Reserve Board's index (1957 = 100). Of course, not all sectors of the economy will share equally in the gain. Machinery producers, for example, can expect their production and sales to rise proportionately higher than some other industries.

The 10% rise in production will be a direct response to brisk sales. Thus, economic optimists predict profits will rise as smartly as St. Nick and his reindeer to the rooftops. They see a 22% increase from $46-billion this year to $56-billion in 1962.

Looking back, 1961 was a year of improvement in almost all aspects affecting business except one—unemployment. This persistent sore thumb hovered at about 6.8% of the nation's labor force from New Year to New Year. Next year it's hoped the situation will improve. The average unemployment rate next year will be more than 1% below this year's, and the incidence of unemployment will decline through the year.

Total gross national income will rise to $562-billion in 1962, $40-billion more than the record for 1961. This is the broadest measure of the economic health—or lack of it—for the country taken as a whole. The 8% increase indicated for 1962 suggests a very healthy patient.

Disposable personal income, a prime determinant of consumer outlays for everything from bread to pleasure yachts, will take a 7% jump to $389-billion next year. Of that amount, consumers will spend $362-billion and sock the rest away for a future vacation, car, or down payment on a house. The largest portion of consumer expenditure will go for non-durable items such as clothing and food.

Consumer spending for durables will improve substantially next year. The absolute dollar amount of spending for these items runs under $50-billion per year. It is only because outlays for hard goods fluctuate so drastically that they always receive careful attention in forecasts of the future.

Businessmen's plans to raise their capital spending strikes another optimistic note on the business outlook for next year. Plans in late autumn of this year called for 4% more investment in new plant and equipment next year. All major industries except electrical machinery and chemicals—and there the declines are relatively small—plan to raise their 1962 investment outlay.

WASHINGTON WIRE

A FACTORY PRESS TIME REPORT

When Congress reconvenes in January the White House will ask for authority to bargain with the enlarged European Common Market. More specifically, the Administration wants across-the-board tariff cuts on broad categories of industrial goods. In addition, President Kennedy will seek authority to make special concessions to underdeveloped nations and to enter into various types of agreements to stabilize commodity markets.

This would mean the end of the Reciprocal Trade Act. In fact, the Administration does not even plan to seek a simple extension when this law expires next June 30. What the President has in mind after that is anybody's guess. He does not seek to join the European Customs Union or to create an Atlantic free trade area. But he and his aides do feel that the Reciprocal Trade Act is obsolete. They feel it must be replaced by something resembling free trade if the economy of the West is to survive. Still bothering the White House planners are two sticky problems: (1) how deep a tariff-cutting authority it should seek, and (2) how broad a range of industrial goods it should base such a search on.

Supporters of the Administration plan are optimistic about its chances of winning Congressional approval—in 1963 if not next year. They see these things in their favor: Protectionist forces in Congress have gained no new recruits recently and are leaderless at the moment; relative prosperity next year will take some of the steam out of the protectionist campaign; growth of the European common market calls for cooperation, not cut-throat competition; an international textile pact and tax concessions to the textile industry will undercut the most formidable protectionist lobby.

Come what may, the ultimate result seems bound to be lower tariffs on foreign goods and more intense competition for U. S. goods both on domestic and foreign markets. On the other hand, the move seems certain to assure U. S. producers a more reliable flow of raw materials from abroad.

The federal method of counting unemployment is under review. The study, ordered by President Kennedy, is aimed just as much at stilling the critics as it is at changing our current rules. Criticism of the present system comes from both sides. Industry sources contend figures are inflated by counting as unemployed students seeking to enter the labor market and housewives seeking a second family income. Labor economists claim the jobless count is too low since it excludes involuntary part-time workers, who are now counted as employed.

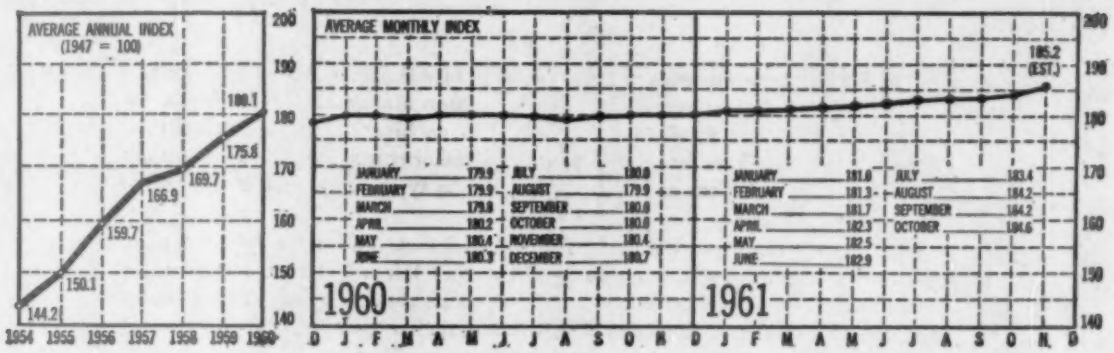
The Administration believes the present system is sound. Even so, the survey will be conducted on a fair basis—partly because of the high caliber of men chosen to make it and partly because the Administration is worried about the persistent high level of unemployment.

Outlook for a tax-revision bill in Congress next year is getting more doubtful all the time. The Administration has failed to whip up much enthusiasm for its two-way plan for an 8% tax credit on equipment purchases—and possibly on plant construction—along with a closing of tax loopholes. The lack of enthusiasm involves both Congress and the business community.

The White House is beginning to doubt the wisdom of even trying to get such a bill through Congress, particularly if business remains wary of the plan. It may let the matter die with only token support and devote all its energies to swinging Congressional approval of its new trade policy. Both the tax revision and any change in trade policy must be cleared by the House Ways and Means Committee, and either is a major task for a single session of Congress.

COST INDEX OF PLANT MAINTENANCE

A FACTORY PRESS TIME REPORT



Index up again, higher predicted

	AVERAGE 1960	OCT. (Preliminary)	SEPT. (Revised)
Building and Facilities Index	170.6	175.8	175.8
Materials	140.1	140.0	139.3
Brick	154.9	155.5	155.5
Elec. fixtures	131.9	130.9	130.9
Elec. switches, boards, fuses	183.3	185.1	183.2
Elec. wire, copper	147.0	142.4	142.4
Glass	148.1	147.7	147.7
Gutters, spouts, ducts	180.3	180.4	180.4
Gypsum products	140.9	145.3	145.3
Heating equipment	125.5	120.5	120.9
Lumber	128.7	121.1	122.3
Millwork	156.7	151.7	149.8
Paint	130.2	134.1	134.3
Pipe, cast iron	170.4	170.4	170.4
Pipe, steel	190.7	188.7	188.7
Pipe & tubing, copper	151.5	130.6	134.3
Roofing	113.9	127.9	121.4
Sanitary fixtures	162.4	161.8	161.8
Sash, metal frame trim	137.4	136.3	137.0
Solder	122.5	141.6	141.6
Steel, structural	236.3	236.3	236.3
Tanks, steel	139.6	136.0	136.7
Valves & fittings	167.8	162.2	163.8
Wire mesh	163.8	156.7	156.7
Labor	191.8	199.7	199.6
Carpenters	177.3	186.7	186.5
Electricians	199.4	208.8	208.8
Painters	196.2	203.6	203.6
Equipment Index	184.2	188.3	187.9
Materials	177.6	179.9	179.5
Abrasives	157.9	157.4	157.4
Alloys, non-ferrous	123.2	136.6	136.6
Bars & plate, steel	227.2	227.2	227.2
Bearings	160.0	155.2	152.9
Belting	160.9	163.2	163.2
Bolts, nuts & screws	225.2	249.3	248.0
Chain	187.4	193.8	193.8
Controls (electrical)	183.3	185.1	183.2
Gear-reduction units	181.1	174.5	174.5
Hand tools, mechanics	204.5	208.3	208.3
Lubricants	125.7	125.7	125.7
Motors	145.0	132.5	132.5
Non-ferrous metals	135.8	125.5	129.2
Precision tools	158.2	166.2	166.2
Pumps	235.4	197.3	197.0
Tools, cutting	186.8	184.0	182.0
Valves & fittings	167.8	162.2	163.8
Labor	188.7	193.9	193.5
All mfg. labor	185.1	190.8	190.0
Machine tool labor	192.1	197.0	197.0
FACTORY'S COST INDEX	**180.1**	**184.6**	**184.2**

Prices in FACTORY's Cost Index moved about restlessly in October with the average slightly higher for the month. The combined index of prices of materials and labor commonly used in factory maintenance rose 0.4 in October to a level of 184.6 (1947 = 100).

In the buildings and facilities component of the Index, materials prices rose 0.7 despite the fact price cuts out-numbered rises by two-to-one. This anomaly is similar to the situation when stock-market averages rise although a count of the stocks traded on the exchange reveals more fell than rose. Some materials in FACTORY's Index are more heavily weighted than others. This reflects the fact that some items are relatively unimportant in maintenance while others are frequently used. Obviously, several heavily weighted items rose in October.

The index of roofing materials prices was up 6.5 and millwork prices rose 1.9. Among the numerous items on the down side were: lumber off 1.2; copper pipe and tubing off 3.7, valves and fittings off 1.6. This last decline was due to a large cut in gate valve prices which some manufacturers have been making via discounts below list prices.

In the equipment component of the Index, the story is much the same. Materials prices were 0.4 higher, with price hikes outnumbering cuts five-to-two. Bearings were marked up 2.3; controls, 1.9; screws, nuts, and bolts, 1.3; and cutting tools, 2 points.

Labor costs in both categories of the Cost Index were quiet during October. In the equipment area, they rose only 0.4. The rise for the building and facilities index was a scant 0.1. A somewhat larger rise in labor costs in both areas is likely in November. Consequently, the complete Index will probably increase by at least a point in that month.

LOOKING AHEAD IN LABOR

A FACTORY PRESS TIME REPORT

Organizers will get tough again

"A Guidebook for Union Organizers," is being distributed privately to top union officials. It reveals the tactics to be used in labor's new industrial union organizing drive. The 33-page "How To Do It" booklet is the result of (1) extensive studies by labor strategists on how to get the union bandwagon rolling and (2) the experiences of its own organizers currently involved in test projects in Philadelphia and South Carolina.

Nicholas Zonarich, organizing director of AFL-CIO's big Industrial Union Department, says in a forward to the booklet: *"We have learned from exprience that our call for 'organizing the unorganized' has had little or no effect upon the workers we seek to bring into the labor movement.* Why? What are we doing that is wrong?" He goes on: "The vast majority of those with whom I have discussed the problem are convinced there is *no real substitute for the old-fashioned organizing campaign* and all the work it entails. Experience in our Philadelphia and South Carolina projects has proved this point."

The industrial union drive in these regions is, actually, a trial run—a combined effort by unions already established or seeking to invade these regions. A number of other target regions has been drawn up. The go-ahead will be given if the methods are successful. So far, success is limited, particularly in Philadelphia, although the IUD claims seven election victories in the Spartanburg-Greenville, S. C., region. These include workers in textiles, metal fabricating, meat packing, and bakeries. It is the first broad union movement in the South for some years.

The organizing booklet discounts the advice—prevalent in labor's own circles—to change and "clean up" the organizer's image. Union labor's failure to keep even with the growing work force, let alone gain a net increase in members, has brought suggestions for a "Madison Avenue" approach, complete with well-dressed, well-educated organizers to do the job. This is bunk, says the handbook. "The impersonal approach cannot get the organizers' message over to unorganized workers."

The handbook notes that "There are no absolute formulas for success in organizing." Nevertheless, it lays down a set of standards.

Once a target plant is picked, the handbook suggests these procedures:

• A thorough survey of the employer's operations, including plant facilities, number of employees and their starting and quitting time, eating places, and transportation facilities.

• Locate a plant leader to start the campaign. "If there is any rule at all, it is that contacts are not made by suddenly appearing at a plant gate with a leaflet . . . if no potential leaders can be found, the representatives had better acknowledge the probability that he will not be able to wage a successful campaign."

• After meetings with in-plant leaders, the organizer may start a "quiet" card-signing campaign or couple it with leaflet distribution at the plant gate. "Once the organizer has held a few meetings with his leaders, he can expect management and the work force to know 'there is an organizer around.'" The handbook warns the organizer to expect a counter-attack.

• Get card-signers' support for house-calls. "Visiting a worker—and his family—at home is one of the most important parts of an organizing campaign. It is a central part of the organizer's efforts."

• Although federal rules require pledge cards from only 30% of the work force, the organizer is warned that "few elections are won with such a showing. Sometimes they are signed to 'get the union off my back.' Whatever the reason, there is no guarantee of anything in a signed NLRB pledge card except that it will count toward an NLRB election."

The handbook, in addition, spells out methods to aid the campaign through publicity: how to write and distribute handbills; letter writing to employees; advertising in newspaper, radio, and television; issuing news releases; and use of billboards.

Finally, the organizer is warned about timing. "An organizing campaign—like a battle—depends on strategy, tactics, and timing. Even though both the strategy and the tactics are properly developed, the campaign can still fail if the representative doesn't succeed in timing his drive so that it reaches its high point on Election Day."

SEE LABOR RELATIONS CLINIC, PAGE 148

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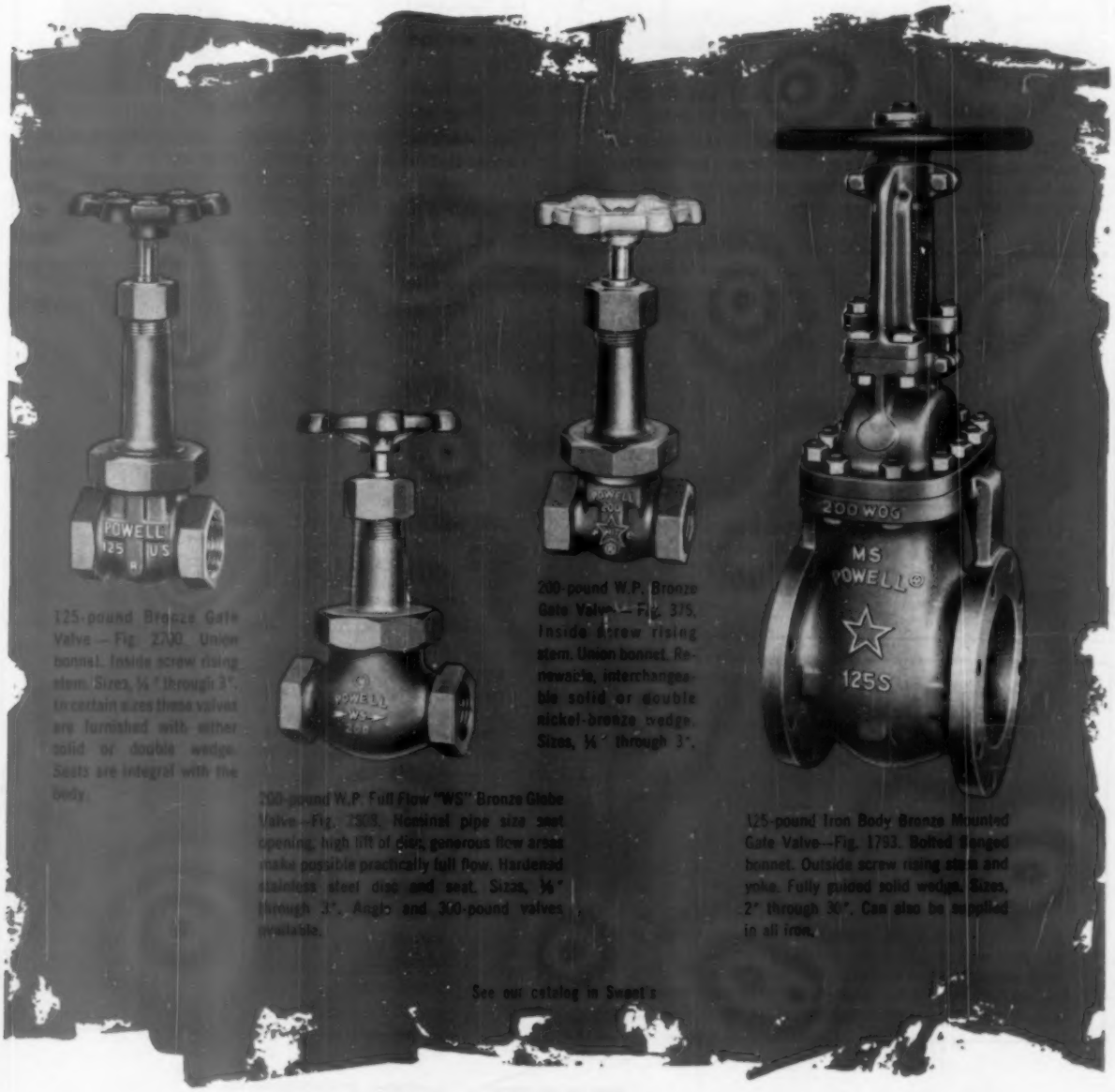

125-pound Bronze Gate Valve — Fig. 2700. Union bonnet. Inside screw rising stem. Sizes, ¼" through 3". In certain sizes these valves are furnished with either solid or double wedge. Seats are integral with the body.

200-pound W.P. Full Flow "WS" Bronze Globe Valve—Fig. 2305. Nominal pipe size seat opening, high lift of disc, generous flow areas make possible practically full flow. Hardened stainless steel disc and seat. Sizes, ⅛" through 3". Angle and 300-pound valves available.

200-pound W.P. Bronze Gate Valve — Fig. 375. Inside screw rising stem. Union bonnet. Renewable, interchangeable solid or double nickel-bronze wedge. Sizes, ⅛" through 3".

125-pound Iron Body Bronze Mounted Gate Valve—Fig. 1793. Bolted flanged bonnet. Outside screw rising stem and yoke. Fully guided solid wedge. Sizes, 2" through 30". Can also be supplied in all iron.

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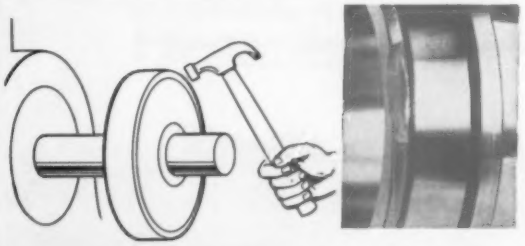
For more facts Circle 439 on Reader Service Card

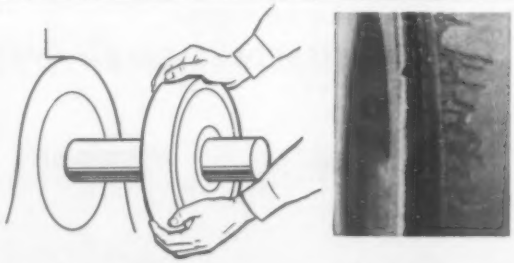
DISTRIBUTOR DAN, the SKF bearing man, lists

THE 5 MAIN REASONS WHY BEARINGS FAIL

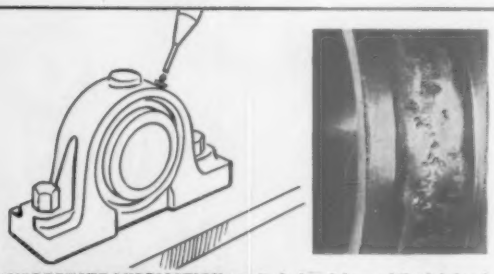
and some helpful tips to eliminate them



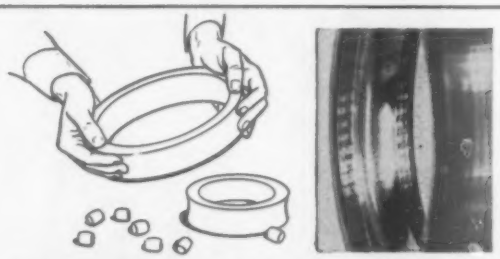
ABUSE DURING MOUNTING. Don't hammer the outer ring of a bearing having an interference fit on the inner ring. Striking the outer ring with a hammer almost always causes denting, brinelling, and even breakage—as shown in the photo at right.



IMPROPER MOUNTING can cause edge-loading and fatigue-flaking, especially in tapered and cylindrical roller bearings. Watch out for off-square mounting or cocking of the inner or outer ring, out-of-line housings or shaft deflection—all of which mean misalignment.



INADEQUATE LUBRICATION results in breakdown of the lubricant by carbonization into a fine abrasive. Heat generated softens the bearing steel and early failure results. So, be sure to give your bearings the right amount of lubricant in the right place at the right time.



DIRT AND OTHER PARTICLES will often cause denting, as shown at right. Even soft particles—brass, aluminum, wood and paper—can dent a rolling surface. Protect your bearings by using effective seals and maintaining cleanliness at all times.

CORROSION CAN START if you wash the bearing in cold solvent and then cover it with a cold slushing compound. The moisture can't evaporate so it expends itself in corroding the steel. To prevent this, immerse the bearing in hot oil or slushing compound and allow it to assume the temperature of the bath.

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FACTORY

The "local" issues– labor's latest tactic

Watch carefully the injection of "local" issues into labor's bargaining mix. The tactic was originated this year by Walter P. Reuther, United Auto Workers chief. It's sure to set a style that other unions—big and small—will follow.

The local-issue tango goes like this: Top union and management negotiators agree to discuss the big "economic" issues. Plant-level squabbles (work rules, etc.) are left for rank-and-file leaders and operations management to settle. On the premise that wage increases are the vital point of difference, top management aims there for agreement. The union chief quickly accepts the company's offer. Too late, it is discovered that plant-level discussions are snarled on "local" issues.

"Too bad we can't control the locals," says the union chief (in a tone reminiscent of John L. Lewis' surprise when all his mineworkers became "sick" at once). "What now?" asks top management. "Well," says the union chief, "perhaps if you and I can agree on basic 'non-economic' issues, the locals will come into line."

So now you have "non-economic" issues. What are they? Here are a few: more full-time paid committeemen, more paid relief time, more restrictions on subcontracting, more say in plant relocations. Of course, such issues aren't "non-economic"—they're as economic as wages. Yielding of management prerogatives always costs money.

And what if top management doesn't want to yield on "non-economic" issues? Then, mysteriously, the "local" issues suddenly swell in importance. The result is that management is caught between the whipsaw of "local" issues on the one hand and "non-economic" issues on the other.

Obviously, the local-issue tactic does not in any way alter basic union strategy, which is to get more of everything. But the new tactic is wonderfully flexible for union goals. It can be played with many variations. One of its insidious aspects is that the quick economic—or money—settlement is thrown by union leaders as a sop to the Kennedy Administration's plea for non-inflationary contracts. As in World War II under wage stabilization, unions are now trying to make devastating inroads into management's rights—under the subterfuge of "non-economic" issues.

What should management negotiators do about this? Don't permit the union chiefs to split the contract package into parts. Don't permit "local" issues to be isolated from "economic" issues. Don't be distracted by labels like "non-economic." Always present a united front of top and plant management to the union.

For a revealing look at how rank-and-file union members become the pawns of labor's latest bargaining tactic, read Larry Mihlon's first-hand account of his day on the picket line (page 90).

L. R. Bittel

EDITOR-IN-CHIEF

automate PLANT

Management spends over $250-million a year to combat crooks in this country. But the thieves are still winning by a 4-to-1 margin; losses from industrial theft run at least a billion dollars a year. Vandalism, sabotage, and fires caused by intruders jack the bill up still higher. Most of this cost can be avoided—economically. Automatic detection devices could save $100-million a year in plant protection costs, and give industry much better protection into the bargain.

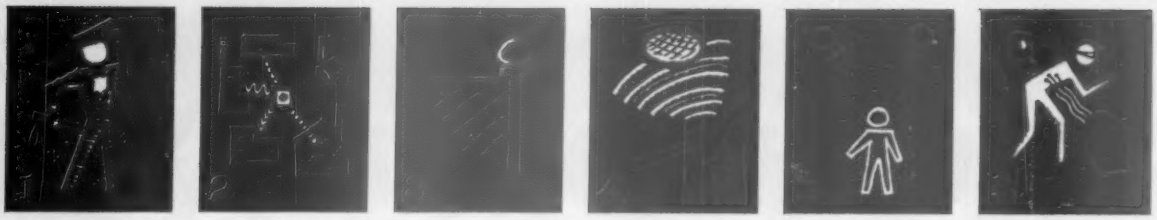
First step is to determine what should be protected. Many companies try to protect too much. For example, some manufacturing plants are open day and night. A security system covering the entire building would be wasteful. Only a few areas really need protection.

After you decide what areas to protect, the next question is when should an intruder be detected? Long before he gets near the plant, or after he reaches a specific area or room? At most plants, perimeter protection plus interior surveillance of the area is probably best. This combination gives you protection in depth. If an intruder is clever (or lucky) enough to get by one system, he will be trapped by the others. Such a set-up spots not only the crook coming from the outside but also the stay-behind thief—the one who lurks inside until everyone has gone.

If the plant sprawls over a large area, or includes a number of buildings, the security system should be zoned to show just where the intrusion is taking place. Otherwise, guards will have to check every foot of fence or every room—and by that time the intruder will be long gone. Silly? An east coast factory planned one warning horn for a building with over 30 entrances! How you zone depends on the particular area. A vertical building might be best zoned by floors; a horizontal layout could be zoned by rooms, buildings, or areas.

Once you know your needs, you're ready to go shopping. Radar fences, electronic and ultrasonic devices, noise detectors, and so forth, have come a long way in recent years. They're more reliable, more sensitive, harder to outwit, and cheaper than they used to be. Trouble is, there's so much stuff available that you can get buried in sales bulletins and still not know what's best for your particular plant. On the next four pages there is a sample of what you can get, what it can—and cannot—do, what it costs, how long it takes to pay off.

PROTECTION



The patrolling guard with a night stick is obsolescent. Sophisticated new hardware "watches" everywhere at once. It's cheap and reliable, does everything but make arrests.

1. GUARDS

In a factory, guards can be stationed at fixed points or be on moving patrols. A roving patrol covers a lot more territory, but there are periods—long periods—when a *given* area is without any protection whatsoever. Security devices in these areas can protect them between guard visits.

You can contract for guard service from world-famous firms like the William J. Burns Agency and Pinkerton's National Detective Agency (both N.Y), or from any of a number of regional and local companies. These firms will supply one man or an entire guard force—uniformed, trained, and ready to go. They also offer mobile guards who will check buildings periodically, looking for signs of break-in or fire.

The advantages of contracted guard services include lower cost (no hiring, training, or fringe benefits); elimination of administrative, scheduling, bargaining, and emergency substitution headaches; and probably better protection. Your plant is guarded by keen professionals—with no temptation to look the other way—instead of by elderly men with friends on the work force.

A company can set up its own guard force, of course. Like contracting for an outside service, hiring guards costs money. To man just one guard post 24 hours a day takes 4.2 men, figuring in vacations and normal 40-hour stints each week. So a continuous guard post will run you between $25,000 and $30,000 a year. (In looking at these costs, remember that you never really know how much a guard saves you, simply by being there. The thieves he discourages knock over somebody *else's* plant.)

The efficiency of a guard force is pretty low, even assuming the men are alert and reliable. An estimate: A patrol making one round every hour is only 3 to 5% efficient, if the patrol spends as much as 2 minutes at each station. For the other 58 minutes of each hour, that station is completely unprotected. If less time is spent at each place, efficiency and opportunity for detection are reduced even lower. Age, complaisancy, low morale, and vile weather may also cut guard efficiency.

Modern security devices are a lot cheaper than guards, and they demand no fringe benefits. They're always on the job and cannot be led into temptation. But no matter how sophisticated the devices, no security system, by itself, is a substitute for people. No device can exercise judgment, adjust to sudden changes, allow for exceptions, or make arrests. With even the most elaborate set-up, some form of guard protection must be retained. Devices only make the humans more effective. One evidence of this: One of the best-known manufacturers of automatic security devices uses Pinkerton guards to protect its own facilities.

2. CENTRAL STATION

Central station protection is available from a number of companies. American District Telegraph Company (ADT-N.Y.), is probably the best known, but a number of firms offer local service.

These services generally link detection devices in your plant to a central station, usually located some distance away. This central station is manned by the service's own personnel. When an alarm comes in, the dispatcher sends out a patrol to check on the trouble. He also alerts the local police or fire department.

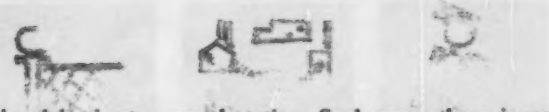
The central station can also monitor your guard force by checking to see that a guard "hits" each of his reporting stations within a certain time. If he doesn't (or if he fails to respond to a local signal in, say, 2 minutes), an alarm is turned on at the central station. So if he's been attacked, or disabled, help is automatically sent to him.

The detection devices are usually switches, wire tape, pressure-sensitive floor mats, radar and electronic fences, etc.

A new twist on the central-station idea is for a group of companies to set up their own central station, each paying part of the operating expenses. Each factory selects the security system that best fits its needs, and plugs itself into the central station.

3. FENCES

A fence offers more of a psychological than a physical barrier. Given time and secrecy, a determined burglar can go over, under, or through any fence. But a fence will expose an intruder, and delay him long enough to permit a guard to get there. Moreover, you can hang detection devices on it that will blow the whistle when



an intruder tries to get through. For example, the fence may include a "taut wire" (Honeywell, Minneapolis). When anyone touches or cuts this wire, an alarm sounds at a guard post—but the intruder doesn't know that he just called the cops.

For adequate protection, there should be a clear strip of ground about 20 feet wide on each side of the fence. An ordinary fence can't do the job alone. You need to combine it with some other form of detection, keep it well lighted, and back it up with a guard force or a protection service.

4. NOISE DETECTION

Essentially, an audio detection system is a long-range hearing aid. It permits a guard at a remote location to hear a prowler moving inside an area or trying to get in. When it "hears" something unusual—footfalls, axes, drills—it turns on an alarm at the guard office. It also "hears" explosions, machinery malfunctions—any sudden or unusual noise. When a guard gets the alarm signal, he can flip a switch and listen in on the area to find out what's going on.

Major companies making noise-detection systems are Honeywell, ADT, and Mosler Safe Company (Danbury, Conn.). A basic system consists of microphones in the protected area, a speaker at a guard station, and connecting wires. The number of microphones needed to protect a given area depends on the range and sensitivity of the mikes and the characteristics of the area itself. Filter circuits cut out low- and high-frequency noise extremes for better detection. Because the system detects unusual noises, it can work only when the background noise level is comparatively low. Otherwise, the sounds of a burglar at work would be drowned out by the racket in the background.

An audio system can be set so it's sensitive enough to pick up even catlike steps on a carpet. But too much sensitivity is a handicap—the alarm might be triggered by a clap of thunder, or the rumble of a passing truck, or an airplane flying overhead.

Noise detection systems are inexpensive—a complete system can be installed for $1000. They combine perimeter and interior protection; can detect both "stay-behind" thieves and intruders breaking in. Another advantage is that some systems combine the pick-up mike with a loudspeaker, so guard personnel can talk back and forth. During the day, the system serves as an intercom.

5. MOTION DETECTION

Motion-detection systems, too, use sound to spot intruders, but they use an entirely different principle. Audio-detection discovers burglars by the noise they make; a motion-detection system picks up the thief's movements which cause changes in the frequency of the sound waves.

A motion-detection system has three basic elements —a transmitter that fills an area with sound waves, a receiver tuned in to the same frequency, and an alarm signal back at a guard station. So long as there is no motion in the area to distort the pattern of sound waves, the frequency picked up by the receiver is the same as that sent out by the transmitter, and no alarm sounds. But any motion within the area disturbs the sound pattern, turning on the alarm.

Honeywell, ADT, and Walter Kidde and Company (Newark, N.J.) are major manufacturers of motion-detection systems. Their systems differ in the frequency of sound used. Honeywell's "Sono-Sentry" uses audible sound waves, which are somewhat less likely to be triggered by false alarms, such as a curtain being moved by radiator heat. The Kidde and ADT systems use ultrasonic sound waves. A burglar can't hear them, so he thinks the area is unprotected.

At one time, audible systems had a high-pitched whine that could be distracting. But with newer designs, the volume and intensity have been cut 'way down—without losing any effectiveness.

Sensitivity of both systems can be set to pick up the slightest movement. But here again, fine adjustment makes them susceptible to false alarms. Cost? An area of 50,000 square feet can be protected with a "Sono-Sentry" for about $1000 installed.

6. PHOTOELECTRIC

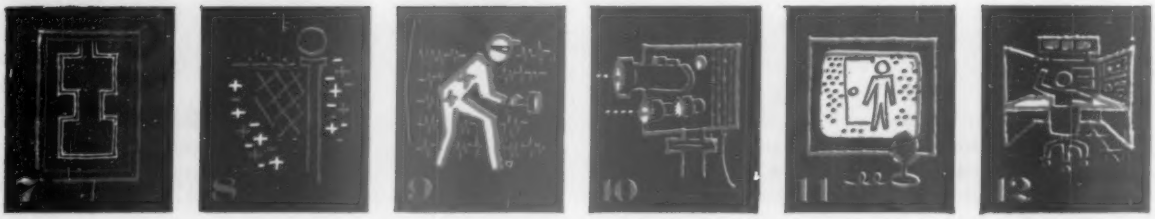
A photoelectric system is basically the same set-up that opens supermarket doors as customers walk out. Elements of a photoelectric system are a light source, giving off visible or invisible light, a light-sensitive cell, and connections to an alarm at the guard station. Light from the source is beamed to the cell, which converts it into electrical energy. Interrupting the beam sets off the alarm.

Visible light is almost worthless in a security installation—an intruder can spot it immediately. An "invisible" beam of infra-red or ultraviolet light is better, but there's still a faint glow at the source. An experienced intruder, equipped with special filters, might spot it immediately.

Some of these drawbacks can be overcome by using a flickering beam; one that is interrupted in a fixed sequence. Usually, this is done with a moving disk at the light source, but a better method is to interrupt the beam electronically. Because the receiver is tuned to the same interruption frequency, an intruder cannot simply substitute another light source to bypass the system. The substitute light would not have the same frequency and the alarm would go off.

Since light travels in a straight line, mirrors can be used to reflect the beam over a wide area, or completely around an object (like a safe). But the system can be defeated if the mirrors are knocked out of alignment or get dirty. Photoelectric systems are often used to fill gaps (doors, gates, windows) in another security system. They're available from several sources—Alarm Devices Manufacturing Company (Brooklyn, N.Y.) Kidde, Honeywell, and others. Set-ups vary, but a "typical" system might cost about $350.

Turn the page



Each type of security equipment is designed to do a specific job best. Or you can weave them into an air-tight system for maximum protection at minimum cost.

7. ELECTROMECHANICAL

Electromechanical devices are the most common, the simplest, cheapest, and easiest to install. They're also the easiest to defeat. An electromechanical system is simply a continuous circuit around windows, walls, skylights, and doors of a room or building. Shorting or opening the circuit at any point sets off the alarm.

Because they're so easy to spot and "jumper," electromechanical systems are often disregarded; but this very drawback can be turned to advantage. By using both electromechanical devices and another security system, you can fake out an intruder. When he bypasses the simple rig, he thinks he's home free, and will blunder through another system he hasn't noticed.

Another point in favor of these easy-to-see systems is that they show the plant *is* protected. This is often enough to discourage vandals and amateur thieves, who account for a great majority of total break-ins.

These devices give perimeter protection, so guards can be on the scene before the burglar gets inside. But they won't trap the stay-behind thief, who fleeces you and then breaks *out*.

At doors, windows, and so forth, snap-action switches can be used. These permit the door or window to be opened during working hours and secured after hours. Costs are hard to estimate, but you might figure on about $30 per door or window.

Wires, strips, or screen can be laced across permanently closed windows or skylights. Tape and foil can surround specific areas. Sensitive mats (Patrick & Wilkins, Philadelphia) can be placed under rugs. Because these are simple devices, they are not susceptible to false alarms—their warnings are genuine.

8. CAPACITANCE (ELECTRONIC FENCE)

With electromechanical systems, an intruder has to break or short the circuit to sound the alarm. Not so with an electronic fence. It may look like a regular wire fence, but it *detects* instead of just deterring. Current passing through it sets up an electrostatic field. Anyone coming within 3 feet of it disturbs the field and triggers the alarm. Such fences are made by Honeywell, Mosler, and ADT ("Telapproach").

A variation of the electronic fence idea is the "capacitance switch" which can be fastened to a metal safe, desk, etc. It makes the object itself radiate an electrostatic field. Alarm Devices (Chicago) is one of several companies that offer these switches.

An indoor electronic "fence" (really a wire) can protect both metal and non-metallic things—you simply run the wire around them. And it's hard to spot, especially if you string it at floor level. Like most of the other devices discussed here, they are designed to "fail safe." Another general point that should be emphasized is that you can monitor the wires on almost any of these automatic detection devices. Any attempt to neutralize the system by cutting or shorting out the wires will in itself cause an alarm.

9. RADIO FREQUENCY

A radio-frequency security system saturates an area with invisible electromagnetic waves. Any absorption of this energy changes the antenna loading and sets off an alarm. The waves are not affected by air currents or sound waves.

Radio (RF) waves are extremely penetrating, passing right through most materials. This characteristic is both an asset and a liability. On the one hand, the waves permeate an entire room, so an intruder can't hide from them. But they also go right through the walls, so any movement that cuts the wave pattern—even outside—will trigger the alarm. One answer, where exterior movement is unavoidable, is to shield the security areas. But this is expensive. Fortunately, with some devices you can "load" the antenna, so as to "shape" the wave pattern, and make it fit the area to be protected. In many cases, though, you may *want* to detect movement outside the protected area.

RF devices are small, easy to set up, and comparatively inexpensive. The system itself can be installed for about $500, but if you need shielding, it might set you back many times as much. RF systems are made by Electronic Security Corporation (Webster, Mass.), Sentron, Inc. (Somerville, Mass.), Singer Sewing Machine Company (Bridgeport, Conn.), and a few others.

10. CLOSED-CIRCUIT TELEVISION

An audio system extends the ears of a guard, and a closed-circuit television system extends his eyes. The TV camera surveys an area and transmits what it "sees" through coaxial cable to monitoring screens. Closed-circuit TV is available from Philco Corporation (Phil-

adelphia), General Electric Company (Schenectady, N.Y.), Sylvania Electric Products, Inc. (New York), Allen B. Dumont Laboratories, Inc. (Clifton, N.J.), and several other companies.

Closed-circuit TV is costly ($500 to $1500), but it can save a real pile. Often, a TV camera can replace a guard post. Originally, TV wasn't much good in outdoor situations because of changing light conditions. Now, though, automatic lens-opening devices have licked this problem.

While the TV camera can see, it can't sound the alarm. And guards find that staring at an image of a closed door is pretty boring. The answer: Use some other device to tell them when to look. An electronic fence, for example, could signal the guard when someone approaches. He can then check the TV.

An installation doing government work uses three TV cameras to guard a remote entrance. When someone wants in, he stands in front of one camera and lays his identification on a table in front of another. A third camera surveys the entire room. At the remote station, the guard checks the man on one screen, sees a closeup of his ID card on the second. The third screen shows the over-all entryway, so no one else can sneak through. When the guard is satisfied, he presses a button to open the door. Similar set-ups are used at other plants to check remote gates after hours.

11. DOOR AND GATE CONTROL

A gate control system combines central operation of remote gates—even miles away—and an intercom between them. A person wanting to go through a gate presses a button, alerting a guard at the panel. After identifying the visitor through the intercom, the guard releases the electric gatelock. A light on the panel tells the guard when the gate has been closed again. Indicators show the position of each gate—from fully open to fully closed. A complete package system—control, intercom, closed-circuit TV, and central panel—is available from Honeywell.

Less elaborate set-ups are also available. At the Timken Roller Bearing plant in Canton, Ohio, a gate control system is rigged to signal the guard if any gate is opened after hours. And an "automated" employee gate is saving $20,000 a year at Atlanta (Ga.) Steel Company. The main gate is on the south side of the yard, but a lot of employees use a small north gate, which used to be guarded 'round the clock. The guard is no longer there, since the gate has a card-key locking system (leases for $300 a year). Employees carry special cards that they stick into the lock to open it. But if your company makes anything smaller than locomotives, an unsupervised gate like this might become a funnel for loot pilfered by employees.

12. INTEGRATED SYSTEMS

Integrating the various intrusion-detection devices into one compatible system can be a big problem. Fortunately, Honeywell, ADT, and perhaps a few other manufacturers offer electronic "security centers" that do just this. The control console combines alarm systems for fire, equipment failure, safety and temperature controls, intrusion detectors, and surveillance devices—all in one package. One man at one point can shepherd an entire plant, handling duties that otherwise would require a number of men. Sound expensive? Look at it this way: An eastern manufacturer put one in and cut his guard force from 15 to 6 men. Saving: $55,000 every year, from here on in . . . plus better protection than he had in the first place.

GOOD AS IT IS, THIS EQUIPMENT CAN'T BE PLUGGED IN AND FORGOTTEN

Whether or not an elaborate, centrally controlled security system is justified depends on many factors. Personnel policy may be more important than budgets, for instance—and both may be over-ruled by defense contractor requirements. The important thing to keep in mind is that there's more than one way to avoid getting skinned. Decide upon your security needs first, and let these, in turn, dictate the equipment for that particular installation. The variety of hardware available allows you to be a very hard-nosed shopper.

Maintenance of these devices is extremely important. If it malfunctions (or is attacked), it should blow the whistle, not just go quietly out of business. Preventive maintenance is available on a service basis from reputable firms. Don't buy this stuff the way you do a quart of milk. The vendor's responsibility should go far beyond handing you a carton of parts.

Intelligently used, security devices and systems can reduce both costs and losses—often by a huge amount. A patrolling guard force is very likely the most inefficient group in the plant (through no fault of its own—the nature of the job precludes human efficiency). Automatic devices can reduce the inefficiency tremendously. Each device, though, is more like a die than a scout knife—designed for one specific job. Be selective; there are no cure-alls.

Another point to bear in mind is that some property doesn't need (or isn't worth) elaborate protection. Cull these out, then buy the most economical (not the cheapest) system that will give proper protection to the rest. Finally, don't expect this gear to perform any more miracles than your shop equipment does. Security devices can do an excellent job, but like computers, they have a certain amount of "sex appeal." So make sure nobody buys a radar set when a padlock would do the job.

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Acid tank leak (left) drives production workers out of area. Foreman (above) calls for fast help.

Maintenance service dispatcher takes the call, starts broadcasting a trouble code over PA system.

EMERG

Acid-resistant suit and breathing apparatus are quickly donned by plumber as other two men assist.

On the job quickly, with the right tools, crew gets the leak stopped before there's extensive damage.

t utility foreman hears "9701" PA system, immediately re- nds via radio in his truck.

Help's on the way. Utility supervisor and two plumbers with emergency equipment rush to site.

ENCY!

nber stands under an emer- cy shower to wash away traces cid before getting out of suit.

Post-mortem by production and maintenance managers searches out cause, insures against repeat.

IT'S AN EMERGENCY! Location: plating room. Trouble: serious leak in a chromic acid tank. Leak is reported to the PEMO room (plant-engineering-maintenance-order service desk) at 10:20 a.m. At 10:22 four men respond to the call—plant utility foreman, plumbing supervisor, two plumbers with tools. At 10:25 another plant utility supervisor and four craftsmen join them. At 11:02 the repair is completed.

This sort of minor emergency happens at GELAC (Georgia Division, Lockheed Aircraft Corporation, Marietta, Ga.) about once a week. But downtime caused by major failure of any utility is equally short-lived at this plant. An organized plant emergency program sees to that. Aided by a fast-acting communications setup and earmarked repair equipment, selected repair crews are trained to make swiftly all necessary moves to remedy utility system breakdowns. These include water, sprinklers, compressed air, steam, electrical, natural gas, sewage, waste disposal, refrigeration, and related auxiliary equipment.

What's the payoff? Savings can't be measured in dollars. But no one at GELAC questions the results when he thinks of the delays or protracted shutdowns that could happen without an organized approach to utility breaks or failures. Employee safety is a valuable by-product. Says B. E. Alexander, maintenance service planner: "Shortly after start-up, we realized the need for a formal plan to cope with any kind of utility emergency. Our plan has supplanted confusion with order, delay with dispatch, danger with safety."

ORGANIZED FOR ACTION

This is not a disaster-control program. That is handled by a separate committee. Nor does it cover the failure of production equipment. That is handled swiftly through PEMO and regular maintenance channels.

The emergency organization is headed by E. J. Docekal, plant engineer. But he doesn't have to direct all field activities. In substance, the organization is set up to operate functionally, with the foreman of the leading trade affected by the emergency in charge. From 5 to 50 men may take part. For example, in an electrical emergency, the electrical foreman calls the shots. On second and third shifts, other maintenance foremen take over until the regular-shift foreman can be summoned from home. On weekends, administrative people in plant engineering are similarly charged with "in-event-of-emergency" responsibilities. Alternates are indicated for key positions.

The program provides personnel coverage around the clock, seven days a week. This includes a foreman, a supervisor with repair and labor crews, and sometimes men from other service organizations, such as fire department, guards, and transportation. Each man's name appears on an organization chart drawn up to meet specific types of trouble. For example, on the day shift the chart for the water system is headed by the plant utilities foreman. Under him are (1) a plumbing supervisor with five plumbers and three laborers, (2) a service pumping operator, (3) a water-sewage supervisor with two men in a "re-route" crew. Equivalent assignments appear on other shifts. The charts are kept in the PEMO room. Production people are not involved.

Turn the page

...A well-equipped command post directs the mobile emergency crew

PLANT-WIDE COMMUNICATIONS

The PEMO room is the command post for all emergency activity. It's equipped with telephone, radio, autocall, and public-address systems. A distinctive numerical code—9401, 9501, 9601, 9701—alerts the appropriate foreman to an emergency. For example, when PEMO receives an emergency electrical request, it calls the foreman by name on PA with the added signal "9401." Simultaneously, all other affected personnel hear the signal and contact PEMO for instructions. Men not within PA hearing can be reached by radio in vehicles, or by a special messenger. Any team member at a distant work site informs PEMO when he is "out-of-service," and where he can be reached by telephone.

When called, the foreman proceeds to the emergency site where he directs activities. He keeps in touch with PEMO through a walkie-talkie or truck radio.

Complete power failure to cut off communications is unlikely, as a secondary feeder serves emergency lighting, critical process areas, and PA. Further support comes from battery sources for telephone and radio, and from 125-kva. and 156-kva. mobile generating units.

AN EQUIPMENT TASK FORCE

Emergency crews can commandeer any material handling equipment in the plant. Maintenance itself has 10 vehicles, all radio-equipped (two-way), to pitch in if needed. Among these are craft vehicles for transporting men and materials (line crew, paint, electrical, plumbing, roads and grounds, electronic), and a Skyworker with boom and basket. Also, specific equipment has been provided solely for emergency service, or earmarked for emergency priority when needed.

Equipment restricted to emergency service is kept at special locations. It includes:

- One 156-kva. mobile generating unit.
- One 125-kva. mobile generating unit.
- One emergency wagon containing a gasoline-driven generator, a pump for liquid spills, repair parts for plumbing and heating systems, lead for pouring joints, tools for large cast-iron shapes, drop lights, floodlights, 50 sand bags—mostly for plumbing emergencies.
- Two acid-resistant suits with built-in breathing.

Earmarked equipment is used in daily routines by maintenance, but strategically located with respect to shops needing it. It includes:

- One gas welder.
- Two electric welders (gasoline-driven).
- Two pumps (gasoline-driven).
- One 25-kw. power cart.

Movement of this equipment from assigned locations must be cleared with PEMO, which keeps a location log.

TRAINED FOR THE TASK

A topnotch emergency crew calls for the best craft skills. But training in what to do, and when, was considered even more important. First step was the drafting of procedures to cover every foreseeable emergency. These procedures are now contained in a 24-page manual sectionalized according to type of utility involved—water, electrical, steam, air, and so on. The manual was developed by asking all maintenance foremen to write up every conceivable type of emergency and corrective action. These data were then correlated into a carefully spelled-out set of procedures. Because quick and decisive action in instructions is most important in an emergency, all men involved are required to be thoroughly familiar with the manual contents. Aim is to insure automatic response to a situation.

Each section follows the same format. It begins with a complete organization chart showing the place of each member of the team. Then follows a detailed chapterization (indexed in front of manual) of each kind of trouble with specific instructions for action. For example, the steam system procedures tell what to do for (1) water supply failure to boiler house, (2) failure of condensate return, (3) feedwater pump failure, (4) failure in surge tank, and so on, to 11 more possibilities of failure, including a main steamline break.

A board containing a manually operated circuit diagram of the GELAC distribution system is used to train electrical trouble shooters. Complete with switches and lights, it shows the effects of various breaker or fuse openings. Led by their foremen, other crafts periodically attend classes and tour the utilities for which they are responsible.

The most valuable training aid has been the emergency drill, held on an average of twice a month. Sham situations are set up by group supervisors of GELAC's buildings engineering group for either electrical or general utility failures. These men are familiar with all plant facilities, and can predict the most effective corrective action. Maintenance personnel are unaware that the emergency call is only a drill until they contact PEMO. They carry out remedial action verbally at the emergency site. When applicable, emergency equipment is started (pumps, generators) to keep the men in practice.

POST-MORTEM ON EMERGENCIES

Every emergency—real or sham—is recorded and filed at PEMO on an "Emergency Check Sheet." This single-page form lists pertinent data such as caller, time, location and nature, what supervisors were notified, and what workers answered (also clock time). It also lists mobile units sent to site, other departments notified, and what time the emergency ended.

A post-mortem critique session follows every real emergency, to correct mistakes or program weaknesses. Sham drills are followed by a report, circulated to program supervisors, describing their performance and suggesting improvements. Often a drill uncovers the need for new protective elements in a utility system.

These periodic drills and critiques keep the emergency crews in trim and on their toes. Even more, Docekal claims, the drills instill an *esprit de corps* that makes these maintenance people dependable. This of all traits is most needed in any emergency situation.

NEW WAY TO MEASURE PLANT OPERATIONS

This simple usage index of plant facilities allows you to compare past to present performance. It can guide maintenance decisions, predict maintenance budget needs, and control maintenance manpower allocation.

By **OSCAR W. GRAVELEY**, Development and Maintenance Engineer
Union Carbide Metals Company, Division of Union Carbide Corporation, New York

Union Carbide Metals Company, Division of Union Carbide Corporation, has a multi-product and multi-plant set-up. It has submerged arc furnaces and electrolytic and vacuum facilities for production of ferro-alloys. It has briquet-making, thermal, and other processes for a wide variety of products.

With such a product mix, subject to changing levels of output, how can a maintenance manager know what should be the proper manning to maintain the entire plant, or for a division operation, at any given time? It was this very question, in fact, that led the author to examine the problem as a whole. And it led to a technique that can produce simple operating data on which to base accurate manpower requirements, and by which to compare over-all performance on any number of chosen dates.

This technique permits the summation of any number of non-related operations to yield a single figure that can be used as a permanent index of operating rate measurement. We call this figure "Percentage of Facilities Operated" (hereafter called PFO). With it you can:

. . . Compare past and present maintenance costs.
. . . Predict maintenance labor requirements to match changes in operating programs.
. . . Check variable requirements of supervision.
. . . Derive idle capacity and maintenance dollar allowances.
. . . Compute amount of activity in manufacturing areas.
. . . Appraise extent of utilization of investment.

A RELIABLE INDEX OF PLANT ACTIVITY

Up to now, industry has been using various ineffective bases for defining activity of operations. Some common ones are: direct labor, units of output, value added by manufacture, kilowatt-hours of power consumption, and dollars of sales. All these and others have been tried. Some were found useful when applied to a single product, but none was accurate for multi-product operations. The trouble comes in trying to add apples, peaches, and pears.

"Percentage of Facilities Operated" (PFO) is UCM's name for the common denominator that enables a summing up of unlike activities into a single figure. With it you can make operating comparisons for different periods. It represents the percentage of capacity at which a plant (or department) is being operated. It relies on the current replacement cost of the investment for its calculation.

The theory behind the derivation of PFO is this:

1. Every facility has a relationship between cost of investment and cost of labor needed to operate and maintain it. This varies for different plants or operations. It can be developed from plant records.

2. The ratio of maintenance labor to investment cost is reasonably constant year after year. For example, a $1-million investment of 10 years ago that cost $30,000 per year to maintain would now cost $60,000 to maintain if present replacement cost were $2-million.

3. Therefore, if you know the current replacement cost of any facility and its operating rate, you can predict today's maintenance requirements.

UCM tested this technique with 11 years of maintenance cost records, back through 1950. There was a remarkable consistency between actual experience and that calculated by use of PFO throughout the whole investigation. The accuracy expected of a single PFO index at company level is $\pm 1\frac{1}{2}\%$. In no test at any level was the difference more than 5%.

What is the practical application of PFO? UCM can now compare the present cost of maintaining a plant (or department) at any level of operation with past cost at any level. How? By direct comparison of such costs *when projected to the common denominator of 100% PFO*. For example: Assume an operating condition 5 years ago, at a calculated PFO of 50%, and with an actual maintenance cost of $10,000 per week. The question: How does this compare with the *same plant* today showing a PFO of 75% at a maintenance cost of

$15,000 per week? The answer: *When extended to a base of 100% PFO,* both periods show $20,000 as the cost. Therefore, since both periods show the same relative cost there was no improvement in 5 years.

This same method can be used to forecast maintenance costs (or manpower requirements) if the expected PFO can be established. Likewise, it allows a direct comparison of actual PFO values for indicating plant activity. For example, a plant PFO of 60% now as compared with an earlier 50% shows a 20% increase in usage.

At this point you are probably questioning whether a straight-line relationship exists between any given level of facilities usage and percentage of facilities operation (PFO). Or between the latter and maintenance manpower. UCM checked five of its plants for different levels of operation between 30 and 100%. The study showed a straight-line relationship for all practical purposes. However, at zero operations a standby maintenance manpower cost still exists.

To make fair comparisons between present and past operations you must be sure to compare only the *same facilities.* Obviously, a plant (or department) that has doubled in capacity is not comparable in operating costs or manpower requirements to the original plant. However, this limitation is no serious barrier. Units that have since been added need only be treated as separate entities. Their operating performance can be viewed separately by use of the same technique. On the other hand, a plant (or department) can be treated as a single entity from the date of the last addition to capacity. If this happened, say, 5 years ago, comparisons of the entire operation are valid from that date on.

The work sheet at the right is all you need to get started. Here, item-by-item, is how you compute the PFO index

(The values given here are hypothetical, yet representative of an actual pattern of experience.) This work sheet has two main areas: "Standard Data at 100% Operation" and "Current Operation." Once computed, the first area (columns 1 to 5) doesn't change. It is altered only for changes in facilities or facility values. The second area (columns 6 to 9) is computed by filling in the columns with current operating data and comparing them with the standard data in columns 1 to 5.

Column 1—Department. The work sheet covers only one of several major operations in a plant, in this case the metal processing department. Now we can add up the apples, peaches, and pears for this operation. Similar work sheets are needed for all other major operations if a view of the complete plant is wanted. In computing PFO for any plant (or department) you must subdivide it into its major production components. The general rule is that a subdivision be limited to a single type of product. This insures a PFO that will reflect changes in product mix.

Column 2—Product. This is merely a key-word description of the end product.

Column 3—Manufacturing units. Note whether it's a single production unit or a multi-unit operation, and the type. Also note if the equipment is operated only a part of the time that other equipment operates.

Column 4—Rated capacity. This rating should be done carefully, for the accuracy of PFO depends on it. It involves choice of the unit of measure, and determination of 100% operating capacity.

Unit of measure. Its choice is the key to success in PFO's application. A department should be rated on its ability to produce in terms of output (units or weight of product or similar count). You have to find a unit of measurement that reflects both manpower requirements *and* output. If it does not do both, you won't be able to interpret plant operating reports into current capacity figures (column 7).

There usually is a unit of measure in every manufacturing area that will qualify in this dual capacity. At UCM the problem was easily solved by asking department heads. They had no trouble in supplying units for all types of operations. Occasionally, there isn't a satisfactory dual rating for a department. In that case, you'll have to settle for a rating such as "equipment hours per day."

Operating capacity is a practical reflection of maximum output under normal work schedules—not theoretical full capacity. Factors that affect theoretical capacity include: limitations in use because of allied operations; restrictions because of manual influences, such as rate of manual feeding; downtime for servicing —scheduled and unscheduled maintenance.

In arriving at a departmental capacity, be sure to develop subdivisions (like furnaces) to the degree that you can accurately rate and measure all levels of activity in the operation. UCM found it could usually establish a single unit of measure for each department. But you may have to go as far down as a single production unit or machine.

Column 5—Replacement cost. This can be obtained by applying a factor representing the percentage increase in cost since the date of installation. Identical facilities installed at different times will show closely the same current replacement cost. The question of replacement by differently engineered facilities doesn't get into the problem. You are concerned only with *what is already installed,* and what an identical replacement would cost at current labor and material values.

There are various published data you can use as a factor. Tables of labor rates over the years are available at the U. S. Bureau of Labor Statistics. If the facility

WORK SHEET—PER CENT OF FACILITIES OPERATED (PFO)
YEAR—1960

Standard Data — 100% Operation					Current Operation			
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
Department	Product	Mfg. Units	Rated Capacity	Replacement Cost, Dollars	Units in Use	Output	Per Cent of Facilities Operated	Replacement Value in Use, Dollars
Metal Processing								
Refining / Melting	Steel	Furn. #1 Furn. #2 Furn. #3	50T/Day " "		#1 #2	50 tons 25 tons	100% 100%	
			150T/Day	1,200,000		75 tons	66⅔%	800,000
Casting	Steel castings		150T/Day	800,000		75 tons	50%	400,000
Pattern	Patterns	Wood working	800 eqmpt. hrs./day	1,000,000		400 eqpmt. hrs./day	50%	500,000
Cleaning / Grinding / Shipping			150T/Day	1,000,000		105T/Day	70%	700,000
Dept. Totals				$4,000,000			60% (PFO)	$2,400,000

involves much construction, the ENR (Engineering News-Record) construction index might be applicable. For machinery and plant equipment, try FACTORY's Cost Index (Editor's Note: See page 55 for current index).

Sometimes you don't need to resort to this kind of factoring of original investment values. More and more plant controllers and insurance departments have replacement values at hand for any distinct and separable breakdown of assets you need. Property engineers might be able to give you distribution ratios of property, building, and equipment investments without much trouble. In fact, should you adopt PFO, your controller can regularly feed you all the needed basic and updating data.

Column 6—Units in use. With this column you begin the PFO computation. It's needed only to show to what extent subdivisions of column 3 (manufacturing units), if any, are productively active. Data for columns 6, 7, and 8 come from plant operating reports.

Column 7—Output. This is expressed in terms of units of capacity being produced. In the first item of the exhibit, covering three similar furnaces, No. 1 is producing its full capacity, No. 2 only half, and No. 3 is inoperative.

Column 8—Per cent of facilities operated. Derived from operating reports of amount of utilization of rated capacity (column 4). In the case of the three furnaces, both Nos. 1 and 2 were reported in full use. Note that total tonnage output of the three furnaces is not proportional to the equipment usage as it is with other items in this exhibit. Also note that the over-all PFO (60% in this case) is not computed at this time.

Column 9—Replacement values in use. Multiply replacement cost (column 5) by the per cent of facilities operated (column 8).

Computation of over-all PFO. At this point you can compute the PFO index for this entire metal processing department. You can't do it by averaging column 8. You add both columns 5 and 9, and divide the total of column 9 by the total of column 5. In this case it's $2,400,000 ÷ $4,000,000, or 60%.

Now, by developing a work sheet similar to the above for all the logical divisions of plant or company operations, the same technique can be used to derive a single PFO index that adds up any and all diverse operations —plant-wide or company-wide.

Once the standard data are accumulated, a PFO index can be figured for any over-all operation within 20 to 30 minutes. And the data come from traditional operating reports that need no special upgrading for this purpose.

Since developing and applying the PFO technique, UCM has found that it can simplify the computation by sampling. If the statistics from *prime* producing subdivisions of each department are used, they form a valid base for the entire plant operation. For example, 10 prime operations will show PFO indexes almost to the same percentage point as will a total of 60.

Turn the page

MAINTENANCE ANALYSIS WORK SHEET
YEAR—1960

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
Year	Plant Replacement Cost 1960 Values	Standard Mtce. Cost at 100% PFO	Actual PFO	Standard Mtce. Cost at Actual PFO	Actual Mtce. Cost	Annual Cost Index	Actual Mtce. Cost Adjusted to 1960
1960	17,000,000	510,000	75%	390,000	312,000	172	312,000
1959	17,000,000	510,000	64%	310,000	260,000	172	260,000
1958	16,600,000	500,000	70%	350,000	380,000	168	389,000
1957	15,600,000	470,000	80%	376,000	354,000	158	385,000
1956	15,000,000	450,000	90%	405,000	353,000	148	410,000
1955	14,000,000	420,000	75%	315,000	260,000	143	313,000
1954	13,300,000	400,000	60%	240,000	183,000	140	225,000
1953	11,600,000	350,000	80%	280,000	220,000	134	282,000
1952	10,600,000	320,000	85%	272,000	200,000	130	265,000
1951	10,000,000	300,000	80%	240,000	160,000	116	237,000

Now that you have the PFO index,

Only direct production facilities are considered in determining PFO. "Indirect" functions such as maintenance are excluded because they have no influence. But when checking the operating status of an indirect function, it's necessary to compute the replacement value of the entire facility it serves, to arrive at fair comparisons. If it serves only a part of a plant, then only that specific part of plant replacement cost should be included in comparative calculations.

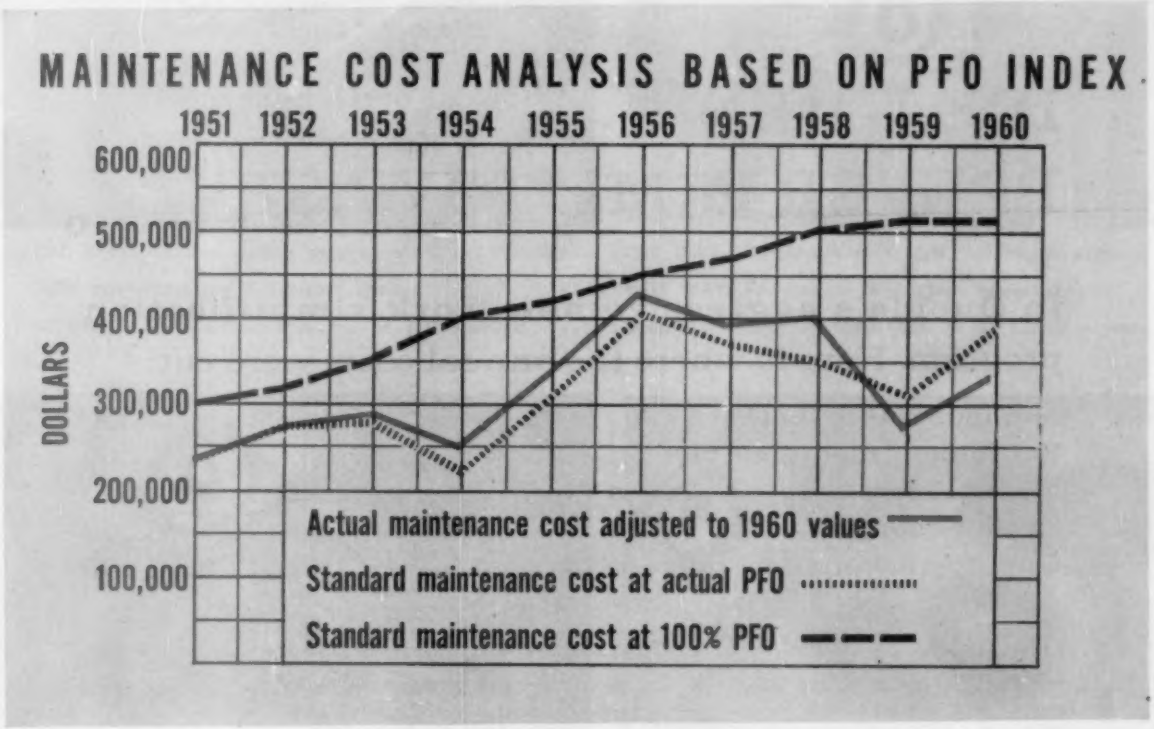
Let's examine a study of the maintenance department as an example. Thorough tests by UCM have proved that a determinable relationship exists between direct and service operations. Maintenance has shown valid cost relationships in:

- Operating departments whose own rate depends on individual activities, such as a furnace department.
- Departments that bear direct relationships to total plant activities, such as receiving.
- Areas with nearly fixed costs, not related to plant activities, such as buildings and grounds.

The maintenance cost relationships are not necessarily straight-line. So you have to find the relationship by examining actual costs incurred at known operating rates. UCM did this by listing actual maintenance costs for an entire facility for years back. It then modified the costs (as by use of FACTORY's Maintenance Cost Index) to reflect costs at current values. These were tested against current replacement costs. In a typical test over several years the ratio of maintenance cost to replacement cost might range between 2 and 4%.

One sticky little adjustment enters here because you still don't have a standard relationship at 100% operation. Is it 2%, 4%, or somewhere between? To get this, you select a trial percentage, say 3%, from which you calculate dollar values of maintenance costs over the years (based on 3% of replacement values). Then you multiply these dollar values by the PFO index. Now compare these computed values with your actual maintenance costs (adjusted to present values). If the alignment of computed values year by year with adjusted actual costs is consistently higher (or lower), repeat the operation with a lower or higher trial percentage until you find the percentage where the alignment most closely coincides. That percentage is the standard for 100% operation.

Now you are ready to analyze your maintenance costs to see how good or bad they are. First step is development of the "Maintenance Analysis Work Sheet" shown above. The data used in this example are evolved for the entire group of diverse company operations each



here's how you apply it

year, as in the PFO Work Sheet (page 71) for a single department. The plant replacement cost (column 2) is the sum of all direct and indirect facilities benefiting from the gross maintenance expenditure.

The standard maintenance cost (column 3) is the product of column 2 values and the standard maintenance percentage (3% in our example).

The PFO in column 4 reflects annual plant activity. To find column 5, multiply column 3 by column 4.

Actual maintenance cost in column 6 comes from plant accounting records.

Column 7 lists a wage and price adjustment index, such as FACTORY's Maintenance Cost Index. Its purpose is to adjust past costs to present wages and prices.

Divide column 6 by column 7 and multiply by the index for the latest year (172 for 1960) to get the adjusted actual maintenance cost in column 8.

The important elements of the Maintenance Analysis Work Sheet (at left) are columns 3, 5, and 8. They are more meaningful if shown graphically as above.

You can see there the reasonably close parallellism between the standard and actual costs up until the years 1957-1958. This typifies an actual situation at UCM. At that time a work sampling program of worker utilization showed agreement with a good national average of "men working" 40% of the time. In 1958 UCM started an improvement program based on standard procedures and work sampling, which brought the "working" score beyond 60%. As a result, you can see how the "actual cost" in 1959 dropped below the standard cost and remained below in 1960. PFO proved useful in reflecting improvement due to definite action, and in showing how much.

This tool of PFO can be useful to a maintenance manager in many ways. It allows quick and reliable cost comparisons, hence better control. For any given rate of output you can compute what the standard cost should be. Easy projection of future maintenance costs makes for better budgets. Rising trends in actual costs spur improvement programs, and falling trends confirm their success.

Someone may raise the question that since the PFO index is of historical derivation it fails to account for improvements in methods, equipment, and tools. This fact does not destroy its value. You need only watch how you use it. To check improvement from year to year, use only one previous year to check against the current year. But for budget purposes you must use a span of years, to take out short-cycle effects and include long-cycle effects.

IDEA-MEN PREFER FAME TO CASH

in Oneida's aggressive new work simplification program. Here is where the annual costs were cut:

Methods improvements	$212,000
Equipment modifications	$121,000
Material and supply changes	$131,000
Layout changes	$ 68,000
Quality, reclamation, other	$ 78,000

Oneida Ltd., Silversmiths in Oneida, N. Y., discovered the value of publicly recognizing employees for making cost-reduction suggestions. Such an approach has provided the impetus for sustaining interest in a plant-wide work simplification program.

The $1000 A Year Club has generated substantial savings by rewarding proposers of $1000 cost reductions with membership. Election is a sign of meritorious contribution by the employee to the good of the company and its workers. This honor is enhanced with much fanfare and ceremony. Semi-annually top management arranges a dinner, complete with cocktails, to welcome new candidates into membership. Candidates' husbands and wives are also invited.

To commemorate the occasion, the president presents each new member with an award. The first year it's a fountain pen imprinted, "Member of the $1000 A Year Club, Oneida Ltd." Succeeding years' awards are pieces of silver service engraved with the member's name. This is a moment of great pride for both the employee and his wife. It will be relived again and again in conversations in the plant, home, bridge club, etc. The importance of prestige cannot be overestimated.

IT PAYS OFF

These evenings of recognition and entertainment pay handsome dividends to Oneida Ltd. In the three years 277 proposals provided net annual savings of $610,137. As seen from the summary above, these proposals cover broad areas but methods improvements are predominant.

Three proposals alone are saving $47,112 a year. The largest ($27,747) eliminates an entire set-up in the drop hammer department. The second, worth $11,524, simplifies the removal of protective coating (Sauereisen) from assembled table knives with a wire wheel instead of washing and hand wiping. The third improves the reclamation of scrap silver.

But these are spectacular improvements. The average proposal saves $2700 per year. Typical ones are shown at right. Oneida feels there is a lot more to be gained through large-scale promotion of modest improvements. Their total far exceeds the dramatic few. This is the reason why the incentive for club membership was set at the relatively low figure of $1000.

Not overlooked are safety proposals. Some 61 of special merit are now in use. Realizing that safety was as important as reducing job costs, management made such suggestions eligible for club membership.

ADMINISTRATION IS SIMPLE

The procedures governing the submission of proposals are like any other suggestion system—with one exception. An employee may still submit a $1000 cost-reduction proposal for membership, even if it is the result of an assignment to a cost reduction project.

A cost specialist in the industrial engineering department calculates all monetary savings. The safety engineer evaluates accepted safety proposals on a numerical scale, which consists of three major factors:

- Degree of originality.
- Importance of the change.
- Degree of applicability to other departments.

Each factor is worth a maximum of 50 points. Benchmarks assist in the rating. A score of 121 to 150 points is equivalent to one year's club membership.

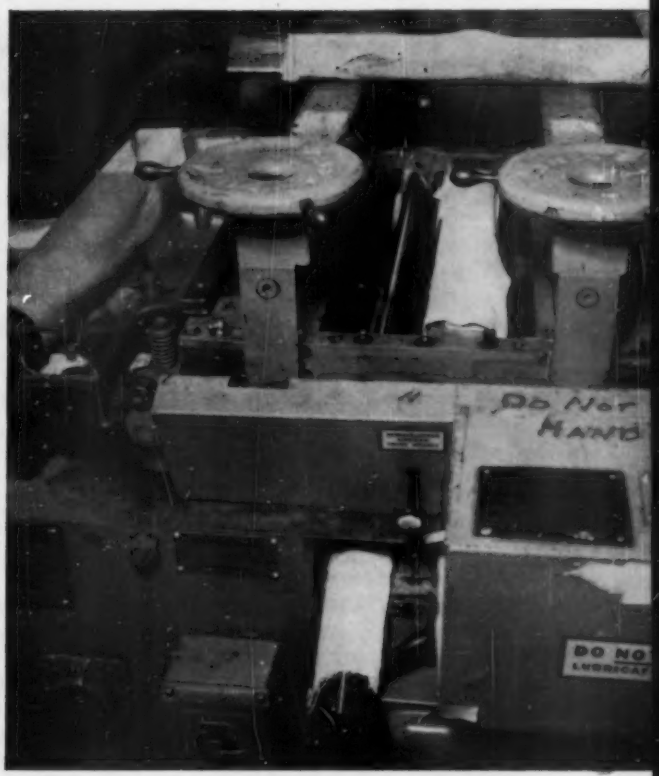
A committee from the employee advisory board, composed of hourly employees, meets monthly to discuss the status of the club's program. These meetings serve also as a basis for exploring areas where cost reductions or safety improvements should be made.

OLD WAY: Outline cutting dies were 10½x12½ inches.
NEW WAY: Dies are 1x2 inches shorter.
BENEFITS: Less die steel, savings of $1070 a year.

OLD WAY: Hand-truck transports welding equipment.
NEW WAY: Powered truck propells equipment.
BENEFITS: Less lost time, savings of $2500 a year.

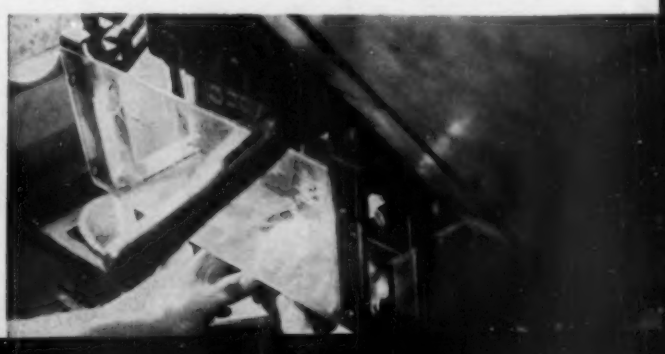
OLD WAY: Used compound drums were destroyed.
NEW WAY: Drums are cleaned and resold to supplier.
BENEFITS: Lower compound cost, savings of $2400 a year.

OLD WAY: Metal strap bound copper stock.
NEW WAY: Pressure-sensitive tape binds stock.
BENEFITS: Less surface damage, savings of $2520 a year.



OLD WAY: Straightener cleans strip with top wiper rolls.
NEW WAY: Bottom wiper rolls are added.
BENEFITS: Less refinishing of strip, savings of $1000 a year.

OLD WAY: Holloware presses had awkward guards.
NEW WAY: Presses use simplified, see-through guards.
BENEFITS: Greater safety, improved working conditions.



Flooding sea water brought in by Hurricane Carla gave electrical equipment a brutal test. Here, repair crews steam-clean a priority high-voltage circuit breaker (left) and drain salt water from a motor (center) prior to rebuilding. Extensive repair was done with equipment in place (right).

What industry learned from Carla

Industry's experience with the Texas hurricane, the worst in this century, taught some new lessons in disaster preparation and recovery. The big troublemaker was water—not wind—even though gusts over 150 mph. were recorded. And salt contamination in flood water posed worse problems than oil, mud, or other débris, particularly to electrical equipment and instrumentation.

Almost all the plants in the area were chemical and petrochemical process plants, most of them big, heavy users of electrical motors and automatic controls, with little in the way of buildings or machine tools. The plants, from Lake Charles, La., to below Corpus Christi, Tex., began their shutdowns according to organized plans on Friday, Sept. 8. These were pretty well completed by Saturday night when the floodwaters started to sweep inland. Most of the plants suffered only minor damage—broken windows, minor flooding, knocked-down power lines.

But the story for plants hit by *seawater flooding* was different. Damage and production loss figures are still not complete, but are certain to total several million dollars.

Most of the preparation measures were well planned and properly carried out. The magnitude of the problem and limited manpower availability made it impossible physically to remove critical instrumentation, drives, or records from the damaged area. (For instance, Texas Refining Company had a big computer under installation that was badly damaged.)

Some protective measures worked in reverse. Plants put fork trucks, over-the-highway trucks, and automobiles inside buildings to protect them from wind and rain. But when the real danger turned out to be flooding, critically needed transport equipment had to be overhauled before it could be used. In fact, for several days after the hurricane, there just wasn't a truck for rent anywhere in the area. Fork trucks, for example, are priceless for pulling out water-soaked motors or controls and returning them to service. This same lack of transport can be expected after any large-scale disaster.

The experience also pointed up the importance of fast communications. Plants with portable and mobile two-way radio equipment kept it operating round the clock, some right through the worst of the storm. Monsanto Chemical Company (Texas City) turned one of its engineering conference rooms into a communications center, installed branch phones for key men, plus a direct line to its St. Louis headquarters.

Long before the hurricane had neared the gulf shore, equipment manufacturers with big installations in the area had gone into action to provide men, equipment, and replacement parts as fast as they could be used. C. E. Price, manager of Westinghouse Electric Corporation's major apparatus repair department, said his company had flown in 100 skilled workers from as far away as New York and Denver.

Competent planning, experience, and long hours of skilled work accomplished unbelievable levels of output of rehabilitated equipment within the first few days. Success was possible for three reasons:

1. Many plants made commitments to service shops before the storm.
2. Service shops themselves requested special help from equipment manufacturers beforehand.
3. Manufacturers in many instances anticipated these needs.

"We flew in 55 experts from 18 of our shops throughout the country and hired more men locally. A good many were on hand waiting for the roads to reopen into the flooded area," General Electric's western regional manager of service shops (San Francisco), P. E. Fisher, told FACTORY. "One of the secrets in fast clean-up operations is to bring in some key men who have worked together on other emergencies. Some experts don't work well under pressure. Others thrive on it. You have to know how to pick when you're faced with really big jobs."

Top priority had to go to repairing flooded primary power equipment—potheads, current transformers, circuit breakers, other switchgear com-

ponents. This critical job has to be handled by the big shops—the only ones with the skill and equipment to do it. A rash of these super-critical jobs came close to tying up all of the experienced manpower of the big shops in the area for the first day or two.

What kind of equipment was in short supply during this first phase of recovery? Much substation overhaul work was done with the equipment in place where portable power and heat sources were available. Many plants were caught without enough emergency generators, steam cleaners, or gasoline engine-driven pumps. According to one observer, this equipment would have paid for itself in the first few hours of use. Some plants, too, were without a reserve supply of fresh water. Even a few thousand gallons would have made it possible to get equipment back on the line hours sooner. You can't flush out salt water with brackish water. G-E's P. E. Fisher pointed out that the vapor degreaser units brought in were great for cleaning up motor components. "You have to watch out for a few types of insulation. Otherwise, they do in a few minutes a cleaning and drying job that normally takes hours."

Relays and panel instruments took an awful beating from the sea water. The brass, spring steel, and aluminum parts corroded quickly. Many were so badly damaged they had to be completely replaced.

The experience proved quite a testing ground for motor insulation. Thousands of motors were under salt water for several days. Any weakness in the insulation offered an opening for salts to lodge, then caused a failure later. Some of the short cuts taken at Dow's plants offer a lesson for other industries. According to Dow engineers, 7000 out of approximately 12,000 motors at the two Freeport plants were flooded.

After allocating priority to those motors needed to operate key processes, Dow sent some 3000 motors to 20 different shops (both motor manufacturers and independent), many of them up to 300 miles away. Most of these motors were under 100 hp. Dow was able to repair another 2000 motors in its own maintenance shops. The typical flooded motor needed cleaning, drying, revarnishing, baking. About 5% of them needed complete rewinding; another 5% were scrapped.

Dow decided to take a big-scale calculated risk with the remaining 2000 motors. They were mostly motors purchased in recent years, open-type construction, with windings that were either epoxy-encapsulated or insulated with silicone rubber. The motors (in many cases without being removed from their mounting) were hosed out, washed with a cleaning solvent, and the bearings were flushed out. While still wet, the motors got an insulation test, and then were put back on the line. On a few urgently needed drives, silicone insulated motors were restored to operation after simply drying off the leads. According to one Dow source, results to date have been exceptionally good. There have been a few bearing failures as a result of the short cut, but insulation failures have been almost nil.

Process instrumentation and controls were hard hit by the water—worse than in previous floods. The area uses millions of dollars worth of instrumentation, and salt water starts to attack some instrument parts within minutes after submersion. Some instrument cases contained nothing but fragments when they were opened. Apparently, the water had acted as an electrolyte to start galvanic action between dissimilar metals in the case and the components.

The damage was worse where instrument air pressure was lost, pointing up the need to maintain an auxiliary air supply as a last defense against emergencies. Here, water got into the lines. There was no quick way of getting rid of all of it, so some operations had to go back after a quick flushing. Undoubtedly, the remaining salt will cause corrosion or plug-ups in the future.

Water did damage to relays, recorder-controllers, instrument bearings, chart drives, and transformers, but surprisingly little to resistors or capacitors. Whenever water seeped into vacuum tube bases, the tubes failed when full voltage was put across them. Instrument manufacturers flew in thousands of dollars worth of repair parts to the area and increased their local staffs to handle the service load. Ultrasonic cleaning tanks proved to be a life-saver in reclaiming instrumentation.

One thing surprising to many whom FACTORY talked to was the speed with which bearing manufacturers were able to get thousands of different sizes of bearings into warehouses in the area. "Even though nearly every anti-friction bearing under water had to be replaced, exact replacements were there when we needed them. Some of the bearing suppliers worked around the clock to keep up with the motor service shops they were supplying," said C. E. Price of Westinghouse.

Interestingly enough, a breakthrough in equipment reclamation methods may not be too far away. The U. S. Naval Research Laboratory has reported some remarkable accomplishments in reclaiming equipment soaked with oil—and sea water—including motors of all sizes, electronic gear and controls. Basic tools are aerosol sprays, ultrasonic cleaners, and oil- and water-displacing chemicals. Chemicals are cheap and action is almost immediate. Ultrasonic cleaning methods remove contamination trapped in deep crevices. Two reports (Naval Research Labs Nos. 5606 and 5680) available from the Office of Technical Services, U. S. Department of Commerce, Washington, D. C., describe the materials and techniques of use. They also report on field experience on salvage jobs like that following the fire on the *U. S. S. Constellation* a year ago.

Indirect labor costs—A decade o

Runaway indirect costs keep gnawing bigger holes in the manufacturing budget. Here's what has been happening in the most crippling component of those costs—labor.

Ten years ago this month, FACTORY published the first of its surveys on indirect labor wages. Since then we have published 25 of these tabulations, which are supplied exclusively to us by the U.S. Department of Labor's Bureau of Labor Statistics.

What has been the wage pattern in this past decade? It takes no seer to know that wages are up, but there's more to it than that. Let's take a closer look.

First of all, we broke our 25 reports down into four time periods. Period A consists of tabulations published in December, 1951; July, August, and October, 1952; May and September, 1953.

Period B includes tabulations published in April and August, 1954; May and September, 1955; May and August, 1956.

Period C covers May and August, 1957; June and September, 1958; June, July, and October, 1959.

Period D is made up of surveys in our issues of April, June, July, and November, 1960; April and August, 1961.

Next step was to pick representative skills from the list rather than follow each of the 40-odd occupations through the decade. In the area of maintenance, we checked (1) carpenters, (2) electricians, (3) machinists, and (4) mechanics. From the custodial and materials movement section of our reports we investigated the salary of (5) guards, (6) janitors, (7) shipping clerks, and (8) power fork-truck drivers. In the office and technical group, we covered (9) comptometer operators (female), (10) senior draftsmen, and (11) secretaries. The results are shown at right.

Time period A includes the reports from 71 cities across the country; period B includes data from 52 cities; period C covers 55 cities; period D is made up of reports from 54 cities. In each case, the cities that reported were spread out across the continental United States and balanced out the regional differences that have been strikingly consistent over the past decade. For instance:

- Lowest wages (for every skill) are paid in the deep South, with the biggest differences applying to non-skilled workers, especially women. For example, last February, women janitors and cleaners were paid 81¢ per hour in Jackson, Miss., while women doing the same work in Detroit were being paid $2.04 per hour.
- Next up on the pay scale is New England. Here indirect labor wages are about 10% less than the national average.
- Near the top of the regional pay ladder come the industrial cities of the Midwest—Cleveland, Detroit, Pittsburgh, etc. All indirect labor runs above the national average, with an extra premium being paid for the higher skills.
- Highest wages—up and down the spectrum of skills—are consistently paid on the West Coast.

There was a surprising consistency in the way all these wages climbed. In every case, the increase between the first two periods was topped by the increase between the second and third periods. Then, again in every case, the rate of increase dropped to its lowest level between the third and fourth periods. (See tables at right.)

This flattening out is attributable to (1) our recently soggy economy and (2) labor's increasing attention to "non-economic" issues. (For a comment on the latter, see this month's editorial, page 59.) Even if the slowing wage climb were to continue, there is little cause for rejoicing. The *amount* of indirect labor is skyrocketing. This means that

ebility

even though the cents-per-hour increases aren't as big as before, the total bite is ballooning.

How does management fight back? Unfortunately, in many plants *all* indirect labor is labeled bad and out comes the axe. Panicky managers have been known to put three men on direct labor to avoid one more man on the indirect payroll.

Happily, there's a proven solution to the ogre of indirect labor costs. It's simply good management—the same good management that has been applied to direct labor. It means boosting productivity, setting standards, furnishing modern equipment to do the job right, questioning the usefulness of every proposed job expansion. Consider, for example, one of the most inefficient men in the industry—a patrolling guard. Even the most conscientious one is woefully ineffective. But modern security systems can change all that. (See page 60.)

In every indirect area, people are poorly managed, poorly equipped, poorly scheduled, and poorly motivated. It's not surprising that this jungle of inefficiency is industry's target for really impressive cost cutting in the years ahead.

Turn the page

AVERAGE HOURLY PAY

	PERIOD A 1951-1953	PERIOD B 1954-1956	PERIOD C 1957-1959	PERIOD D 1960-1961
Maintenance				
Carpenters	1.86	2.17	2.50	2.71
Electricians	1.95	2.25	2.68	2.84
Machinists	1.96	2.24	2.68	2.87
Mechanics	1.84	2.14	2.50	2.65
Custodial & materials movement				
Guards	1.51	1.76	2.06	2.26
Janitors	1.28	1.49	1.74	1.83
Shipping clerks	1.55	1.86	2.11	2.21
Fork-truck drivers	1.52	1.79	2.07	2.14

AVERAGE WEEKLY PAY

	PERIOD A 1951-1953	PERIOD B 1954-1956	PERIOD C 1957-1959	PERIOD D 1960-1961
Office and technical				
Comptometer operators	50.96	59.31	69.06	72.01
Senior draftsmen	79.71	91.23	107.70	117.19
Secretaries	61.94	66.19	81.68	84.79

HOURLY INCREASE BY TIME PERIOD

	HOURLY INCREASE BETWEEN PERIODS A AND B	HOURLY INCREASE BETWEEN PERIODS B AND C	HOURLY INCREASE BETWEEN PERIODS C AND D
Carpenters	30¢	34¢	21¢
Electricians	31¢	43¢	16¢
Machinists	31¢	43¢	19¢
Mechanics	29¢	37¢	15¢
Guards	25¢	30¢	19¢
Janitors	22¢	24¢	10¢
Shipping clerks	30¢	26¢	9¢
Fork-truck drivers	27¢	29¢	7¢

WEEKLY INCREASE BY TIME PERIOD

	WEEKLY INCREASE BETWEEN PERIODS A AND B	WEEKLY INCREASE BETWEEN PERIODS B AND C	WEEKLY INCREASE BETWEEN PERIODS C AND D
Comptometer operators (F)	$ 8.36	$ 9.75	$2.95
Senior draftsmen	$11.52	$16.47	$9.48
Secretaries	$ 4.25	$15.49	$3.10

PAY RATES FOR KEY INDIRECT JOBS—IN 9 CITIES

All figures are average straight-time earnings in manufacturing industries except figures with asterisk, which are for **all** industries. They include incentive pay, if any, but **not** overtime, weekend holiday, or night-shift premium.

Weekly earnings are average salaries for standard work week.

MALE JOBS, EXCEPT WHERE OTHERWISE SHOWN

	BIRMINGHAM, ALA. APR. 61	BURLINGTON, VT. MAR. 61	CHARLESTON, W. VA. APR. 61	CHARLOTTE, N.C. APR. 61	CINCINNATI, OHIO-KY. MAR. 61	MILWAUKEE, WIS. APR. 61	NEW YORK, N.Y. APR. 61	PHOENIX, ARIZ. MAR. 61	WATERBURY, CONN. MAR. 61
MAINTENANCE AND POWER PLANT: Average straight-time hourly earnings									
Carpenters, maintenance	$2.91	$2.18*	$3.26	$2.07	$2.76	$2.94	$2.86	$2.80*	$2.48
Electricians, maintenance	3.30	2.65	3.26	2.37	2.97	3.14	3.03	3.15	2.75
Engineers, stationary	2.94	—	3.12	2.47	3.22	2.97	3.37	2.93	2.85
Firemen, stationary boiler	2.73	1.89	—	1.56	2.55	2.57	2.86	—	1.99
Helpers, trades, maintenance	2.48	—	2.83	1.41	2.16	2.20	2.29	1.98	2.02
Machinists, maintenance	3.29	—	3.28	2.20	2.93	3.30	3.09	3.17*	2.72
Mechanics, automotive, maintenance	2.52	2.10*	2.69	1.89	2.79	2.91	2.94	2.73	2.50*
Mechanics, maintenance	3.07	2.63	3.34	2.12	2.74	2.89	2.90	3.02*	2.56
Millwrights	3.02	—	3.27	—	3.01	2.99	2.83	—	2.64
Oilers	2.48	—	2.73	1.47	2.58	2.64	2.44	2.16	2.39
Painters, maintenance	2.85	1.94*	3.21	—	2.96	2.94	2.81	—	2.47
Pipefitters, maintenance	—	—	3.29	—	3.09	3.07	2.74	—	—
Sheet-metal workers, maintenance	—	—	3.35	—	3.15	3.11	2.85	—	2.77
Tool and die makers	2.88	—	—	—	3.09	3.42	3.12	3.17	2.87
CUSTODIAL AND MATERIAL MOVEMENT: Average straight-time hourly earnings									
Guards	2.31	—	2.87	—	2.50	2.31	2.11	2.37	2.12
Janitors, porters, and cleaners	1.84	1.68*	2.24	1.26	2.00	2.10	1.84	1.86	1.97
Janitors, porters, and cleaners (women)	1.46	—	1.40*	.99*	1.74	1.98	1.74	1.44*	1.47*
Laborers, material handling	1.91	1.76	2.47	1.23	2.13	2.29	2.22	1.87	2.04
Order fillers	2.20	—	—	1.38	2.03	2.28	1.99	2.28*	2.72
Packers, shipping	2.15*	1.93*	—	1.38	1.74	2.33	1.87	2.19*	2.27
Packers, shipping (women)	—	—	—	1.14	1.82	2.00	1.77*	—	1.65
Shipping clerks	2.74	2.13	—	1.89	2.21	2.52	2.37	—	2.26
Shipping and receiving clerks	2.64	—	2.69*	1.88*	2.43	2.53	2.29	—	2.37
Truckdrivers, light (under 1½ tons)	1.54	—	—	1.31	2.07	2.36	2.19	2.05	1.98
Truckdrivers, medium (1½ to and including 4 tons)	2.03	2.22*	2.63	1.34	2.41	2.52	3.14	2.32*	1.91
Truckers, power (forklift)	2.27	—	2.52	1.68	2.47	2.56	2.69	2.14	2.58
Truckers, power (other than forklift)	2.40	—	—	—	2.16	2.43	2.48	—	2.16*
Watchmen	1.66	1.29	1.69	1.23	1.72	2.08	1.76	1.59*	1.96

FEMALE JOBS, EXCEPT WHERE OTHERWISE SHOWN

OFFICE, PROFESSIONAL, AND TECHNICAL: Average straight-time weekly earnings									
Comptometer operators	69.00	—	58.50*	65.00	72.50	74.50	82.50	73.50	66.00*
Draftsmen, senior (men)	134.50	126.50	148.50	98.50	118.00	123.00	126.50	115.00	121.50
Draftsmen, junior (men)	96.00	91.00	114.50	79.50	98.00	101.00	88.00	97.00	91.00
Duplicating-machine operators	56.50*	—	—	—	65.00*	62.50	68.50*	—	67.00
Keypunch operators	85.00	—	99.50	67.50	76.50	73.00	73.50	86.00	74.50
Nurses, industrial (registered)	99.00	—	106.50	—	98.00	94.00	105.50	—	95.50
Office girls	57.50*	—	—	50.00*	54.00	55.00*	60.00	—	—
Payroll clerks	74.00	79.00	110.50	62.00	77.00	75.00	81.50	77.50	81.50
Secretaries	94.00	89.00	113.50	81.50	91.00	93.00	99.50	89.50	95.50
Stenographers, general	83.00	86.00	92.00	68.00	73.50	78.50	81.50	76.50	77.00
Typists, class A	81.50	—	87.50	66.50*	74.50	80.00	78.50	69.50*	74.50
Typists, class B	68.50	54.50	70.00	51.50	64.00	65.00	68.00	69.00	63.50

. . . Begins on page 78

Here are the latest figures on indirect labor costs in nine more cities. They help you check your standing in your geographical region (and area wages are becoming more of a realistic guide than industry wage patterns). If you are unionized, you can be sure the union is busy collecting similar statistics. When it has figures and you don't, it can build a tough case in favor of a wage hike.

This is our 26th report of these vital labor costs. Since we're convinced they do an important job of giving management information unavailable elsewhere, we'll keep publishing and updating these figures in the months ahead.

A *FACTORY* ENGINEERING AND TECHNOLOGY REPORT

LEAK DETECTION

NO. 14

A FACTORY ENGINEERING AND TECHNOLOGY REPORT NO. 14

Leak detection on U.S. nuclear sub "Seawolf"

LEAK

Leaks in fluid systems can sap both the quality and efficiency of your product. Here are the fundamentals, techniques, and appropriate equipment necessary to detect and block this concealed "drain" on profits.

By **WARREN C. HUTCHINS**, Manager
Application Engineering Instrument Department,
General Electric Company, Schenectady, N.Y.

ALL MATERIALS LEAK. A leak may be so small it can't be seen when magnified 100 times and yet cause some modern equipment to fail in 30 hours. In this report are some of the lowest cost and most efficient ways to find such leaks.

To find a leak, whatever the nature of your product, you need a leak detector and a leak detection technique. But before you can determine which detector and technique will suit your particular needs, you must set up standards for measuring leaks. Leak test specifications must be established.

A leak is a small hole or flaw through a barrier. Pressure difference from one end of a leak to the other causes leakage. Rate of leakage increases in proportion to difference in pressures on each side of the barrier. Leakage can be measured in terms of cubic centimeter per second, ounces per year, or micron cubic feet per hour, where a micron is defined as the pressure capable of supporting a column of mercury one millionth of a meter high. The terms you use depend upon the product you manufacture. Refrigeration people express leaks in terms of ounces per year of refrigerant; vacuum equipment manufacturers in micron cubic feet per hour. The most universal term and one which might be adopted as a standard is cc./sec.

Air leakage is defined as the volume of air in cc. measured at standard conditions that will leak during each second for any stated pressure difference. Standard conditions are 25 C. at 760,000 microns (or 77 F. at 14.7 psia.). Pressures must be stated since rate of leakage increases with pressure difference.

Refrigerant leakage is usually defined in ounces per year or years for one pound to leak, because each unit is charged with a known weight of refrigerant.

Vacuum leakage is defined in micron cubic feet per hour, and a pressure change in microns per hour. One micron cubic foot equals the amount of air occupying one cubic foot at an absolute pressure of one micron.

Test specifications should match guarantee

Must you repair all leaks? The answer is no. Not all leaks put your product guarantee in danger. Your total allowable leakage is that which still protects this guarantee. Take the case of an air-conditioning unit, which may lose cooling capacity if more than 10 ounces of refrigerant leaks out. Given a five-year guarantee, this air conditioner must not lose more than 2 ounces a year. So if it is assumed there are 20 leaks in the system, on the average each should leak no more than 0.1 ounce per year ($2 \div 20$). To provide a safety factor of 2, the average leak should not exceed 0.05 ounces per year (9×10^{-6} cc./sec.). Such a safety factor should be

DETECTION

cranked into all leak specifications. When you prepare test specifications for finding a leak, follow these five basic rules:

1. Require the unit to be dry and clean when tested.
2. Express all pressures in absolute values such as pounds per square inch absolute.
3. State temperatures in F. or C.
4. State smallest leak to be detected under the terms specified in the guarantee.
5. Require the leak detector to be calibrated periodically, using an approved standard reference leak for the purpose.

Conversion table for units of leakage

This table makes it easy to convert from one method of expressing a leak rate to another. All numbers on the same line (reading across) are approximate leak values at the same pressure through the same physical leak. At very high temperatures and pressures this table breaks down, but for all practical purposes these leak values may be used interchangeably.

Air at Std. Cond.				Refrigerant R-12 leakage		
cc./sec.	Cu. in. per day	Micron cu. ft. per hr. of air	LUSEC (micron liter per sec. of air)	Ounces per yr.	Time for 1 lb. to leak (years)	Immersion test bubble time
1.8×10^{-3}	100	1720	812	100	0.16	1.3 sec.
1.8×10^{-4}	10	172	81	10	1.6	13.3 sec.*
1.8×10^{-5}	1	17.2	8	1	16	145 sec.*
9×10^{-6} (1)	0.5	8.5	4	0.5	32	290 sec.
1.8×10^{-5}	0.1	1.72	0.8	0.1	160	24 min.
1.8×10^{-6}	0.01	0.17	0.08	0.01	1600	240 min.
1×10^{-6}	6×10^{-5}	0.001	4.7×10^{-4}	6×10^{-5}	270,000	667 hr.
1×10^{-10}	6×10^{-7}	1×10^{-5}	4.7×10^{-6}	6×10^{-7}	27 million	7.6 yr.
1×10^{-12}	6×10^{-9}	1×10^{-7}	4.7×10^{-8}	6×10^{-9}	2.7 billion	760 yr.

Standard conditions are 14.7 psia. at 77 F. or 760,000 microns absolute at 25 C. LUSEC is a European term which means micron liter per sec.

Refrigerants R-12, R-22, R-114, air, N_2O and most other gases have approximately the same volume of leakage through any one leak. Helium leakage in volume is about the same as air for leaks of 1×10^{-6} cc./sec. and larger. For leaks smaller than 1×10^{-6}, the volume of helium leakage will be greater than air.

Bubble time is the interval from one bubble to the next and varies widely with the size of the bubble. Time is shown for a leak directed through a tube (3/32 inch ID and 5/32 inch OD) whose end points downward at 45 degrees and is ¼ inch under the water surface. Starred items are based on experimental data. The balance is extrapolated.

No visible water will leak when dry air at the same pressure will leak at the rate of 1.8×10^{-3} cc./sec. Therefore, enclosures for containing liquids should have no leaks at rated pressure that will pass more than 1×10^{-4} standard cc. of air per second. Cubic inch values should be multiplied by 0.946 for greater accuracy.

Testing techniques grow more sophisticated

Some methods of leak detection are simple, but they can't be used where great sensitivity is needed. *Water immersion* requires little or no skill, but it's slow and catches only relatively large leaks. Water surface tension, as well as moisture in the unit, can plug leaks temporarily. And sometimes bubbles that aren't caused by leaks give a false signal. Similar to the immersion test is the *soap bubble method.* Convenient plastic squirt bottles supply the soap solution. Its drawbacks are that you may not see all the bubbles and that you must clean the unit after testing. Again, surface tension may plug some of the leaks. A third method is to *pressurize enclosures* with a fluorescent penetrating dye. Leaks are then spotted under ultra-violet light, or with a developer that changes color when it contacts the leak. Sensitivity achieved with this method is about the same as for the

Detection i

first two. (See "Immersion test bubble time" in the table on page 83.)

A new detection method—one rapidly replacing those above—uses tracer gas. Detectors using this method are available to locate leaks from a pressurized enclosure to the atmosphere or from the atmosphere into an evacuated enclosure. These detectors can be calibrated for leak-size discrimination and testing with them is quick, reliable, and usually low in cost. The tracer gas method also keeps enclosures dry and clean and can detect very small leaks.

The next pages will give you quick reference to the advantages and disadvantages of the various detectors using tracer gas. In addition, here is a discussion, according to use and type, of the most important of these detectors.

Detecting leaks in pressurized enclosures

The enclosure is pressurized with a tracer gas. The "sniffing" probe of the leak detector is then moved along seams and joints where leaks are most likely to occur. Air is continuously drawn into the probe. When the probe tip passes close to a leak, some of the tracer gas is drawn in and detected. The leak signal may be visual or audible, and in some types a relay functions to initiate automatic control.

Types of detectors

The halide torch is inexpensive—$30 as compared to more than $200 for its nearest neighbor. It locates all leaks down to about 8 or 10 ounces per year, but has no means of calibration. A survey revealed that some servicemen cling to this type of detector because it's slow, assuring many hours of labor. Since small leaks can't be found, it also assures call-backs. Another major drawback is that it consumes oxygen and may give off enough toxic gas to make it unsafe in confined areas that aren't well ventilated.

Operation: Flame induces the air through the probe tube. Flame changes color when the air contains enough refrigerant gas. Servicemen usually move the probe about ¼-inch per second to locate leaks down to 8 ounces per year.

Type H-6 electronic halide costs $250, but moves about 25 times as fast as the halide torch for locating the same size leaks. There are several models, each having a control unit with a sensitivity dial, a probe through which air is drawn, and a means of calibration. It locates leaks down to ½ ounce per year. It's intended for field servicing of air-conditioning and refrigeration equipment. Drawback: It can be used only 1 hour out of every 2.

Operation: Air drawn into the probe causes ion emission from hot plate to anode if refrigerant is present. Lamp in the transparent probe flashes when refrigerant becomes great enough. A large leak causes a long flash or a double flash. If the lamp flashes for each of several spots, operator can reduce sensitivity until lamp flashes for only one spot. Probe moves at 1 or 2 inches per second.

Model H6A19 is an H-6 with a bottle for the purpose of checking the detector's sensitivity. The bottle, one-quarter filled with halogenated oil and containing air with about 8 ppm. (parts per million) of R-12, represents a leak of about ½ ounce of R-12 per year. The bottle can only be used in a clean atmosphere.

Model H6SA28 is an H-6 including a leak standard for calibration which is unbothered by atmosphere contamination. The standard is adjustable from 0 to 3.0 ounces of R-12 per year.

Model H6SA48 is similar to H6SA28, but has a special probe that can be used in atmosphere contamination up to 1000 ppm. (Without this proportioning probe it can be used only up to 100 ppm.) The proportioning probe can be adjusted to determine the amount of air that comes through the probe tip. About 95% of the air reaching the detector goes through a filter to remove atmosphere contamination. This detector locates small leaks in areas with inadequate ventilation and in areas that are highly contaminated. It's excellent for installing and servicing large air-conditioning units where large leaks and dumping of refrigerants cause high atmosphere contamination. All U. S. nuclear submarines have this unit.

Type H-2 electronic halide costs $800 and detects leaks down to 0.01 ounces of pure R-12 per year (1.8×10^{-6} cc./sec.). The pistol-shaped probe is connected to the control unit by a 12-ft. cable. Sensitivity

pressurized & evacuated enclosures

can be adjusted, and a separate adjustable leak standard is used as a reference for calibration.

Operation: Probe sniffing the leak causes the leak indicating instrument on the "gun" to swing upscale. If desired, the speaker in the control unit will give an audible squeal. The speaker can cut in at a particular indicator reading. A control relay (optional) will operate at the same point. The sensitive element is a hot platinum plate, the gas is halogen.

Type H-5P electronic halide costs $800 and is like H-2 except that it has a pencil-type proportioning probe. Sensitivity is about the same as for H-2, but it has a 1-second response time. Advantage: The probe is rugged, lighweight, and can be used in highly contaminated atmospheres. It detects leaks down to 0.01 ounces per year. The leak signal is audible or appears on the control unit indicator.

Type EH-1 electronic halide is an explosion-proof model. It's rated at 1.8×10^{-5} cc./sec. (0.1 ounces per year). R-12 is mixed with contents of the systems to be tested. Its main applications are hydrogen-filled generators, aircraft, missiles, gasoline tankers, refineries, and chemical plants.

The infra-red detector, tracer gas N_2O, costs $3500 and up. It's reliable and, unlike most detectors, can be used in contaminated atmospheres (since nitrous oxide is the only gas that affects its operation). This detector remains sensitive for long periods of time and need not be checked daily. It has fairly low sensitivity. The smallest leak it can detect is 2×10^{-4} cc./sec., or a leak that would pass one ounce of refrigerant per year.

Operation: The enclosure is pressurized with nitrous oxide. The probe sniffs for leaks. Infra-red transmission changes as nitrous oxide enters the unit. The leak is indicated by an audible signal and a meter pointer shows rate. The probe can be fitted with a light indicator.

Detecting leaks in evacuated enclosures

Evacuated enclosures will admit air if they leak. You can spot these leaks by connecting a detector to the enclosure and then by passing a jet of tracer gas over the outside of this enclosure. The detector will signal when the tracer gas jet passes over a leak.

Large leaks should be repaired before a high-sensitivity vacuum test is conducted. Suspect large leaks if you have trouble evacuating. But remember that liquids evaporating in the vacuum oppose evacuation, give the impression of a large leak. A similar false impression results from the outgassing of porous materials or air leaking from blind holes under studs that are not center-drilled to allow gas to escape quickly into the vacuum.

Types of detectors

The vacuum gauge costs from $100 to $400. But since gauges are usually installed in all vacuum systems this technique can be convenient and inexpensive. It provides a quick and easy check, but is most effective for locating relatively large leaks. It's usually used as a forerunner to more sensitive detectors such as the mass spectrometer or Type H-4.

Operation: Enclosure is evacuated and then probed from the outside with a jet of acetone. When acetone enters through the leak, the gauge signal changes, indi-

Calibrating detector type H15

Thermocouple vacuum gauge

Gun detector type H-2

Detection—

cating that the jet is on a leak. Helium, hydrogen, or argon can be used in place of acetone. Warning: Hydrogen is highly combustible.

Type H-4 electronic halide costs $1000. It's the lowest-cost vacuum leak detector with a sensitivity of $1x10^{-6}$ cc./sec. Its sensitivity must be checked periodically with a calibrated leak costing from $30 to $50. A relay can be used to initiate control. Response time varies with size and shape of enclosure—normally 2 to 5 seconds. Drawbacks: Sensitivity drops for enclosures larger than about 1 cubic foot; a specialist is usually needed at first installation.

Operation: Detector is sealed in the vacuum system with a cable to a control unit. Outside of evacuated enclosure is probed with a jet of R-12. Leaks admit R-12, which causes ion emission. This results in a squeal indicating a leak. A meter indicates the leak rate.

The mass spectrometer costs $4000 and up. But it's inexpensive to use since the only gas required is for the jet probe. It's reliable, stable, and essentially unaffected by atmosphere contamination. This spectrometer can be used for continuous high-sensitivity production testing. Field servicing of large vacuum and pressure systems is also within its range. If the system you're testing is new, you'll be able to catch and repair all significant leaks before your initial start-up. A crane makes it a simple matter to lift the spectrometer to the test section.

Operation: The detector connects directly to evacuated enclosure (absolute pressure of about 50 microns or less). A jet of helium then probes outside of the enclosure. Helium leaking into the enclosure produces an ion current which is amplified to give an audible signal. A meter indicates the leak rate.

Detecting leaks in tiny, hermetically sealed units

The radiation detector costs $40,000 and up. But maintenance costs should be low and the cost of tracer gas is low because almost all gas is recovered. It uses a radioisotope to find leaks in small, hermetically sealed units. Semiconductors, tiny relays, and practically any small sealed unit (usually 1 cubic inch or less) can be checked this way. This detector pays off when components to be tested range in the thousands per day. It gives 100% testing and can be calibrated for the leak rate to be detected. The manufacturer gives the following labor and gas cost data for testing $\frac{5}{16}$-in. OD transistors:

- Radioactive gas costs $250 per 10,000 or 2½ cents per transistor.
- Activation labor is 15 minutes for 10,000.
- Radiation check takes 0.16 minutes per transistor.

But this detector does have drawbacks. Leaks of $1x10^{-3}$ or larger may not be detected. Also, a 60-hour course in health physics and operation must be given to personnel.

Operation: A large number of small sealed units are placed in the lead-lined tank. The tank is evacuated, then filled to predetermined pressure with radioactive gas. After 10 to 20 hours of exposure, the radioactive gas is recovered and units are air washed. The units are then passed through a scintillation counter. Units that leak will contain radioactive gas and cause audible and visual signals.

Cost of tracer gas for testing pressurized units

Tracer gas cost makes up a major portion of the total test cost. You can keep gas cost to a minimum by using a leak detector with a high sensitivity. As the sensitivity of your detector increases, the % gas (mixed with air) may be decreased.

Example: To locate all leaks down to about $2x10^{-4}$ cc./sec. from a 100-cu.-ft. tank at pressure of 60 psig., start with an air-filled tank at 0 psig. With H-6 (sensitivity $9x10^{-5}$ cc./sec.), add R-12 until pressure is 38 psig., then add air until pressure is 60 psig. Here R-12 cost will be $78 per tank. With H-2 (sensitivity $1.8x10^{-6}$ cc./sec. or 50 times more sensitive than H-6), add R-12 until pressure is 0.75 psig., then add air until pressure is 60 psig. Here, because the detector is 50 times more sensitive, the cost of R-12 is only $1.56 per tank.

roblems, prices, and pitfalls

Selecting the most efficient tracer gas

Helium, nitrous oxide, and refrigerants are excellent tracer gases since they're essentially inert and rare in the atmosphere. When you have a question about a gas with regard to a specific test application, contact the manufacturer or supplier of the gas.

Refrigerants R-11, 12, 22, and 114 are available at most local refrigeration supply houses. They are easy to use and extra safe since you can choose one with the desired vapor pressure range. Thus, you can limit maximum pressure. Also, the maximum test pressure is inversely proportional to the % tracer gas. *Example* (at 77 F.): With 100% R-22, maximum pressure is about 140 psig. With 10% R-22 and 90% air, maximum pressure is about 1525 psig.

Pitfalls of testing and how to avoid them

Pitfall: A pressure rise in a sealed vacuum indicates a leak, but so does outgassing.
Solution: Pressure rise caused by a leak will be a straight line when plotted against time; outgassing will graph differently because it gradually decreases.

Pitfall: Double "O" ring seals can trap gas or air between rings. This air may leak into a vacuum indicating a leak.
Solution: Single"O" ring seals and single welded seams are two answers. Also, don't use threaded joints if they can be avoided.

Pitfall: Bubble checks can be inaccurate. A 10-oz. leak at the bottom of a cylinder that's been pressurized and immersed may cause only one bubble every 30 seconds. Water and oil can also temporarily plug leaks.
Solution: Clean and dry unit before testing. Use tracer gas and a more sensitive detector.

Pitfall: Disagreements can arise between manufacturing, final test, and customer inspectors as to whether units meet leak test specifications.
Solution: Make manufacturing repair all leaks down to half the size that will be rejected by final plant inspection. Make final inspection reject all leaks that are more than half the size allowed by the customer. Each test station should have a reliable leak standard for calibration of the leak detector. Calibration should take place several times a day.

Pitfall: Tracer gas accumulation in surface dust and oil may cause false but large leak signals.
Solution: Clean out side of pressurized unit before probing for leaks.

Pitfall: Testing at higher than rated pressure is desirable but not always conclusive. Some compression fittings leak at low pressure and not at high.
Solution: Test also at rated or lower-than-rated pressure as a double check.

Pitfall: Leak standards can plug up. Checking a leak detector with a standard can mean a faulty detector.
Solution: Keep leaks capped except when checking sensitivity. Keep grease and dirty fingers away from end of the reference leak. A leak standard calibrator is available, but expensive (about $300).

This report includes basic information that should prove useful for the majority of applications. On any new leak testing application, check with a competent leak detection consultant before adopting any particular set of specifications, procedures, and techniques for leak testing. He can usually accomplish more in a day than most manufacturers, working alone, could accomplish in weeks or even months.

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Machine Capability Studies: THE CALCULATIONS THAT COLLECT THE CASH

MCI is a neat gimmick to forecast quality, block defective production, sidestep rework costs, and outpace your delivery deadline.

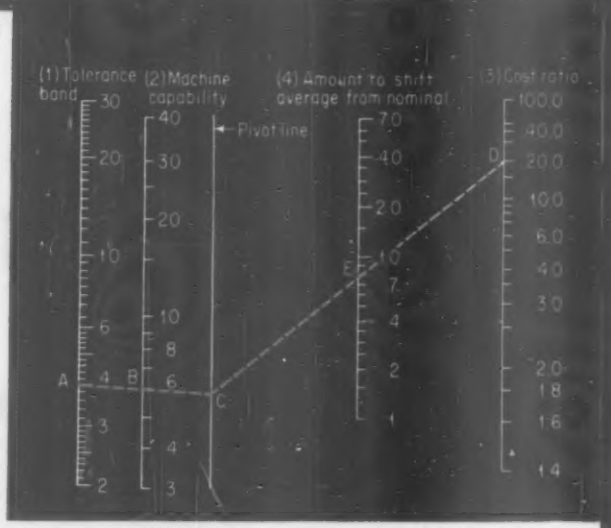


FIG. 1: NOMOGRAPH provides correction data based on machine capability to lower scrap and rework costs.

"I never realized how useful a knowledge of statistics could be," Jim Jones, the plant manager, told his new assistant, Tom. "Last week we had a rush defense contract to turn out 500 steel shafts. Production was moving along nicely but suddenly there was a sharp rise in the number of defectives.

"I found the machine capability of the old tracer lathe had drifted from ± 0.002 to ± 0.006 inch. Defective production would cost $125 in scrap and rework charges. Under normal conditions the lathe should have been closed down for a complete overhaul. But there was a $500 late delivery clause. Then I remembered a paper I read a few weeks ago by a quality manager at Barden Corporation, a manufacturer of precision ball bearings in Danbury, Conn.

"I re-read the paper and concluded that I only had to make a small blueprint change to reduce rework costs to $40 and still meet our deadline. I realized all undersize shafts would have to be scrapped. This cost us $10 each. But oversized shafts could be reworked at $.50 each. By shifting the nominal diameter upward a little we would make only 0.3% undersized shafts and 10.6% oversized. This reduced the cost of defectives by two-thirds.

I had a statistician prepare me a nomograph to simplify the calculations (see Fig. 1). Let me show you how it works. Tolerance band on the blueprint was 4 thousandths, i.e., ± 0.002 inch. This is point A on the graph. I found the lathe's machine capability to be ± 0.006 inch. This is B here. Now, we have to calculate D, the ratio of scrap cost to rework cost: $10 ÷ $.50 = 20. Connecting A with B gives C, and C with D gives E, 0.75 thousandths. E is the amount we add to the shaft diameter to minimize the cost of defective shafts, i.e., reduce scrap and rework costs by two-thirds. Thus, 0.969 + 0.00075 = 0.9698 inch, the new nominal diameter for the shaft.

"Thanks to the basic theory in that paper, Tom, we were able to make our deadline. It's pretty technical, but I suggest you read it. It can help us a lot."

Based on data submitted by JOHN J. RILEY, Quality Manager, The Barden Corporation, Danbury, Conn.

Back in his office Tom lit his pipe, leaned back in his stuffed chair and began to read:

Machine Capability Index (MCI) provides a means of evaluating how well a given machine tool can operate within a tolerance specified on a blueprint. For example, the blueprint for Job X specifies that the outer bearing ring must be ground to 1.000 ± 0.004 inches. The question is whether or not automatic grinder number 5 can consistently machine shafts within this ± .004 inch tolerance? (This is a simplified, hypothetical example—Editor.)

A test run shows that 99.7% of the parts fall within 1.000 ± 0.0033 inches. (99.7% is the range covered by ± 3σ, a statistical measure of the spread of a frequency distribution like the normal curve.)

Now, MCI is equal to the blueprint tolerance divided by the performance tolerance on the machine. In this case it is: ± 0.004 ÷ ± 0.0033, or, 0.008 ÷ 0.0066 = 1.21.

By inspection, it can be seen that if the blueprint tolerance equals the performance tolerance, the MCI equals 1. Also, if the performance tolerance exceeds the blueprint tolerance, then the MCI equals less than 1. Therefore, any MCI less than 1 means that the machine will produce outside of the blueprint tolerance. This will result in scrap and rework. Conversely, any MCI above 1 will mean the machine can always produce an acceptable product. Thus, in the above example, an MCI of 1.21 is very good. Barden feels that a minimum MCI of 1 is insufficient for a machine tool: it allows no margin of safety. Any variation in conditions will cause a process average drift, i.e., an up or down trend causing defective parts. By establishing a 10% safety factor, Barden's minimum acceptable MCI becomes 1.1.

Machine capability varies from machine to machine and from job to job on the same machine. In cases where a machine tool repeatedly shows an MCI near 1.1, the MCI should be calculated for every job. If the MCI is above 1.25, then only occasional checks are necessary. It should be said that machine age can affect machine capability, but age does not mean poor machine capability. An old machine tool in excellent repair can

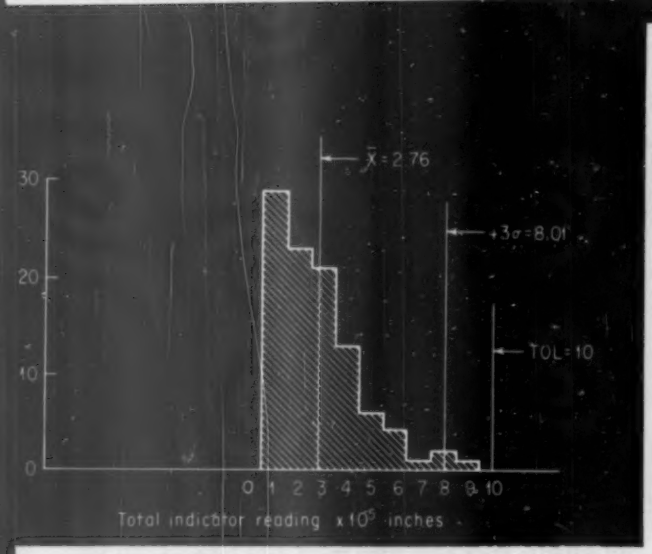


FIG. 2: NORMAL CURVE formulae on a skewed distribution gives misleading machine capability data.

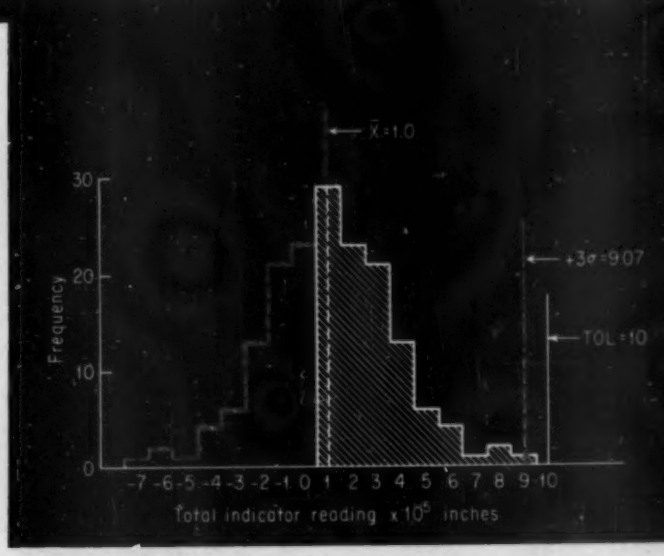


FIG. 3: MIRROR IMAGE approach (red) corrects data in Fig. 2 to give realistic capability for that job.

have a good machine capability for a wide range of jobs. Calculating the MCI in advance will forecast quality produced, maintenance needed, or a different or new machine required.

Sometimes it is easy to be fooled into thinking that a machine has a more than adequate MCI. This can occur when measuring roundness, eccentricity of one diameter to another, squareness, or parallelism of faces. Blueprint tolerances for these dimensions are usually given as Total Indicator Reading. TIR is measured by placing a dial gauge between two surfaces, say the walls of a bearing outer ring. The gauge is zeroed and then rotated around the full inside diameter of the race. The difference between the left and right swings of the needle is the TIR. A $(-5) + (+10)$ equals a TIR of 15. If the part were perfect, this out-of-roundness would be 0.

On high precision work the frequency distribution for these TIR is usually severely skewed. See Fig. 2. This is opposed to a normal distribution, which is symmetrical. To calculate the standard deviation by assuming a normal distribution would give the results in Fig. 2. This in turn would give an MCI of $10 \div 8.01 = 1.25$. The conclusion would be that this machine tool has good machine capability for roundness in this bearing ring. However, experience would soon show that this would be misleading. This would show up in the form of a large number of defective rings.

Barden has developed the "mirror image approach," which compensates for this error. In the above case the mirror image approach, shown in red in Fig. 3, produces a different standard deviation, 9.07 vs. 8.01. This results in an MCI of 1.10, which means that this machine tool has the very minimum MCI allowable for quality production. Thus, it needs careful watching and adjustments on this job.

The mechanics of this technique are as follows:

• Group the data for individual readings in the form of a tally and plot the frequency distribution as shown in Fig. 2.

• Duplicate the readings to the right of the modal cell in a mirror fashion on the left. See red-lined extensions in Fig. 3.

• Insert these mirror values into the tally sheet and complete the following calculation:

X	F	X^2	FX	$F(X)^2$
−7	1	49	−7	49
−6	2	36	−12	72
−5	1	25	−5	25
−4	4	16	−16	64
−3	6	9	−18	54
−2	13	4	−26	32
−1	21	1	−21	21
0	23	0	0	0
1	29	1	29	29
2	23	4	46	92
3	21	9	63	189
4	13	16	52	208
5	6	25	30	150
6	4	36	24	144
7	1	49	7	49
8	2	64	16	128
9	1	81	9	81
Totals: Σ =	171		171	1407

$\bar{X}$ by definition is the modal cell or may be calculated by:

$$\bar{X} = \Sigma \frac{FX}{F} = \frac{171}{171} = 1.0$$

$$\sigma = \sqrt{\frac{\Sigma F(X)^2}{\Sigma F} - \bar{X}^2} = \sqrt{\frac{1407}{171} - (1)^2}$$

$$\sigma = 2.69$$

$$\bar{X} + 3\sigma = 1.00 + 3(2.69) = 9.07$$

Comparison with Fig. 2 shows a mirror image approach more realistically contains the distribution than that obtained with the normal distribution technique.

The mirror image approach results in more realistic evaluations of quality performance. Prevention of defective production through machine capability studies is worth more than elaborate inspection programs.

When Tom put the article down, he was in a reflective mood. Its fundamental reasoning had opened many new avenues in his mind to the problems of handling quality costs.

An inside look at labor unions' latest bargaining tactic — the "local issues." (See this month's editorial.)

MY DAY ON THE STRIKE LINE

By **LAWRENCE F. MIHLON**
Associate Editor, FACTORY

My assignment was to get in the picket line of a struck auto plant. Find out how serious the rank-and-filers were about the so-called "local" issues. How they felt about a strike imposed upon them by the international headquarters in Detroit. I found that the strikers knew next to nothing about the "local" issues. Their feelings were mixed regarding the strike itself.

I reached the strike-bound plant at 10:30 a.m. It sat on the opposite side of the highway from the direction I was driving. At the main gate, four workmen were holding the fort. They just stood there talking.

Across the street was the union hall. It was a squarish red brick building. A hundred or so strikers milled about outside. I drove about 500 yards past the hall to the rear gate of the plant. There were only two pickets standing there. They didn't look very ominous. So I swung the car into the area. I waved hello to the men. They waved back without a second glance. I parked.

I plodded up to the hall. I hoped I looked like a striking auto worker. I made my way up to the front of the milling mob and melted into a line that was forming. There was some pushing and shoving. A few curse words. Some talk about the World Series. Some talk about how long the strike would last. I didn't stand in line long.

A union committeeman came up to me and asked: "Have you signed up yet? You can't get your benefits until you do." He grabbed me at the elbow and half dragged me toward what looked like a locker room. I was in another line. Inside the smoke-filled locker room were two tables placed end to end. Ash trays, beer cans, and piles of paper were strewn around. When it came my turn to sign in, the fellow behind the table said, "What's your badge number and where's your badge?"

I hadn't counted on this. "Forgot it, I guess," as I dug through my pockets. "Better see Frank Black," he urged. Black was the union boss. "He's in the office," the man said. I looked for the door. It was locked. I knocked. A man opened the door. "Hey, Stanley, this guy wants to see Frank." I pushed my way into the office. It was a sparse office. One desk, a phone, a big wall locker, two columns of steel files.

"Where's Frank Black?" I asked a man. "I'm Stanley," he said. "What can I do for you?"

Stanley was a big man. He had a look of "don't give me a lot of bull buddy, just tell me what you want."

"My name's Larry Mihlon," I said. "I'm from FACTORY magazine in New York. How's the strike going?"

He told me the men were behind it 100%. They were ready to stay out for six months if necessary. He said this was a good strike. No violence so far.

We talked for almost 45 minutes. Then Stanley said he had to leave. He left me with a young local lieutenant. Another Stanley. He bragged that he was financial secretary and a working stiff at the same time.

Stanley number two told me about the local's new unemployment system. Credit at local stores for all men on strike who really need it. "It's good for all the time, not just during a strike. Any men out of work or in a bad way can use the funds in the program to get themselves out of a hole."

After we had talked a while, I asked Stanley how much the rank and file knew about what they were striking for. He said they knew what they were striking for. They had voted for the strike, hadn't they? They were behind the leadership 100%.

The conversation petered off. So I thanked Stanley for his help and headed for the door.

On the way out of the office I picked up a strike placard. Stanley didn't seem to mind. I headed for the front door. Things were getting noisier in the union hall. More and more beer cans were being opened. Men crowded and talked aimlessly. They drank a lot of beer. There was no segregation in this room. At least 100 men were packed into the place.

Placard in hand, I walked the several hundred yards to the rear gate of the plant. There were three men standing around in the middle of the driveway. Each had a strike poster tied with white string across his chest.

The poster I held seemed to clear the way for me. I got into the line of pickets. They asked if I were the relief; they had been out there for six hours already.

Next thing I knew they asked me: "How's it going back in the hall? Do you think the strike will last much longer?" They were asking me the questions my editor wanted me to ask them.

I pulled an answer out of the hat. "The way it looks, we'll be out at least for a second week."

They said the way they were being treated by management they didn't care if they had to stay out two months. These were men with some seniority. One was a paint sprayer. Another worked on the assembly line. A third had a dirty job, he said—metal finisher.

I asked the painter which of the issues he was hot about. He was quick to answer: "relief time." This was the issue with most of the men, he said. The man from the assembly line agreed.

I asked who had told them what the strike was about. They said they just knew about it, that's all. The painter said he had lived the issues every day. "We're not animals, you know."

The metal finisher, a colored man, said he didn't care what the issues were. All he knew was that he was out of work, he had a family to support.

Strikers were now driving up to our little group. Seems the pay booth was open inside. They asked whether their pay was there. We said yes.

Then they asked the question that nagged everybody: "How long will it last?"

A grey Volkswagen pulled up by our group. The young man inside said he didn't like the strike at all. He had come in from California four weeks before. He hadn't built up enough time for any pay cushion.

"Guess I'll have to go back on unemployment," he said. "Been on it for a couple of months."

After an hour or so, I walked back to the car. Time to try the front gate, I thought.

The pickets at the front gate looked like the ones I had just left. There were six of them. Two very young men and four seasoned workmen. One of the older men launched a tirade about unionism and the "beasts" of management. Then I asked one of the young men whether he was for the strike.

He surprised me, "No!" All he knew, he reported, was that the strike news was spread around the plant a month before the walkout. Now he was out. All *he* did was follow orders, he said.

The older men seemed well informed on the strike's "non-economic" issues. But their knowledge came mostly from narrow personal gripes. They were more militant in their determination to stay out than the younger men. The latter were more concerned with the length of the strike. A long one would hurt them badly, they said. Even a few more days would break them.

I asked the men whether they'd like a "guaranteed" salary instead of hourly wages.

The young men said salary. The senior men said wages. "When I want to stay home or go fishing, I don't want to worry about getting canned," an older one said. "We like the freedom wages give us," said another.

I tried them out on profit sharing. This was better received. The men said they were disappointed that it wasn't coming up for grabs here.

If they had a vote about anything, they said, they would go for that. It would give them a reason for wanting to work for the company. "Trouble is," said one, "we don't get to vote on anything."

I stabbed from another direction with the next question. "Do you think labor and management will ever bury the hatchet," I asked.

"Never in a million years," the senior spokesman said. The others agreed.

Then I asked them how they felt about tripartite commissions—committees with public or government members sitting in on labor-management disputes. They seemed to know what I was talking about.

"Keep government out of this," they said. "It's none of their business. It's nobody's business but ours."

As evening traffic built up on the highway, big trailer trucks rumbled past. The truckers hung out of their cabs. They shouted and gestured encouragement.

It was past six now, and only once had I heard complaints about the so-called "local" issues.

The pickets' relief came up. The men I had been picketing with left for the union hall. I walked to where my car was parked, tossed the strike placard into the back seat and drove away.

That night I looked at the local papers. "Auto negotiators agree on money matters," UPI's dispatch read. "Unresolved are five non-economic issues on the national level, plus local disputes at 47 plants."

One week later management concessions on the non-economic issues led to agreements by the bargaining teams in Detroit. Within two days 120,000 men at the 47 plants were back at work. No mention was made anywhere of what happened to the vital local issues.

Electronic monitorin

Union officials told the federal court the new Telecontrol was a red-eyed "Big Brother." But a new survey reports a completely different reaction to electronic monitoring by most workers.

A Telecontrol monitoring system had not long been installed at Cutler-Hammer's Milwaukee plant before management was confronted with an official of I.A.M. Lodge 1061. He fumed that the workers had been saddled with "an electronic spy system." He demanded that 21 written controls be placed on future use of the equipment.

Knowing that Telecontrol aided employees as much as the company itself, management decided to fight back, and the case came into federal court. Meanwhile, back on another front, Hancock Telecontrol Corporation, New York, organized a survey to determine the true effects of Telecontrol. They polled the 44 companies who had already installed Telecontrol to determine if the complaints of Lodge 1061 were justified.

Only one plant, out of 28 that responded, positively stated that labor did not like Telecontrol. Two-thirds reported their employees liked it. One-third felt they had no clear indication of worker sentiment or considered it was still too early to make an assessment.

Favorable worker reaction frequently occurred in plants with incentive pay systems. They realized that Telecontrol results in greater individual productivity and therefore higher earnings. In 7 out of 28 plants wages went up. In no plant did they go down.

Management was less positive in speaking of union reactions. About 43% of the respondents felt that the unions were favorably inclined toward the equipment. But an equal number acknowledged no definable reaction from the unions.

Another 10% declared that initially the reaction of employees and union officials was either lukewarm, suspicious, or hostile. But in all cases their attitude changed to favorable after they found out from experience how Telecontrol worked.

There seemed to be a correlation between company approach and worker-union reaction. About 86% of the companies conducted extensive training programs, explaining to their employees the mechanics, uses, and benefits of Telecontrol. The best results were obtained when the orientation program emphasized employee benefits first and management benefits second.

As expected, management was very pleased with Telecontrol—with one exception. One-quarter of the respondents reported that performance of the equipment surpassed their expectations; two-thirds found the results in line with what they had anticipated. But 94% stated that the Telecontrol equipment improved management efficiency. The following list tells how:

REASON	PER CENT
Improves communications	36
Speeds corrective action; controls downtime	18
Allows smoother production	14
Speeds the flow of materials	10
All other reasons	10
Too early to say	18

NOTE: Total exceeds 100% because of multiple answers.

WHAT DOES ALL THIS MEAN?

There are few conclusive findings that can be drawn from this survey at present. But a significant point is that over 40% of respondents had not troubled to sound out their unions on electronic monitoring devices. Lack of such groundwork could result in serious misunderstandings.

But whatever the union reaction, it seems unlikely that management will give up the device. It is not uncommon to find productivity increased from 5% to 25% and downtime slashed by as much as 50% after installation. For a detailed breakdown on Telecontrol's mode of operation, see the box on the opposite page.

Telecontrol is welcome not only as a cost reduction tool, but also as a device to make life easier for the foreman. The control center approach concentrates production problems in one room for more direct handling. It also eliminates much of his paperwork. With the new "readout" system, data on each Telecontrol panel are automatically converted to punched cards at the rate of 100 per minute. This includes shift, date, operator clock number, machine number, standard hours allowed, pay code, and the like.

These punched cards can be processed with basic data-processing equipment to yield payrolls, production progress reports, etc. In fact, some comptrollers were so impressed with the accounting features of this device that they initiated its installation.

There is general agreement at all management levels that all forms of communications are greatly improved, and coordination between production and service departments measurably enhanced.

The versatility of this equipment indicates its use will

OOL or TYRANT?

be expanded rather than contracted. For example, one company has eliminated almost all warehousing with Telecontrol. A limited amount of raw materials is kept on the receiving dock and expedited on signal by Telecontrol as needed. Similarly, finished orders are shipped directly from the production floor.

Another company states that this device, applied to what had always been termed its "bottleneck" department, has achieved a production break-through. Efficiency is up 30% and costs are down proportionately.

Still another reports eliminating one of its six lift trucks, because greater utilization could be made of the remaining five.

Another firm saved $3000 on one order. A short while after the job was started, a small number of monitored results suggested costs were going to be grossly in excess of estimates. Fast engineering changes brought them back into line.

THE ONLY REMAINING QUESTION

Management obviously likes these electronic production control devices. The only remaining question is whether or not labor really opposes their use.

Significantly, right after Lodge 1061 of the I.A.M. went to court over Telecontrol, a sister lodge in Rhode Island did the opposite. It told management it would not oppose a Telecontrol installation in a machinery plant, where it is the bargaining agent.

Public statements by union officials on this subject are hard to find. An official of Local 670, United Auto Workers, did write the following in the Michigan AFL-CIO *News*, "The workers (at Jackson, Mich.)—all of them that I had a chance to talk to—thought very well of Telecontrol; so you members in other locals don't be afraid of it when your company talks about installing it . . ."

An AFL-CIO spokesman confirmed that worker opposition to electronic production monitoring devices is the exception rather than the rule. He indicated that where disputes have developed, they have been settled at the grievance level. He cited the Cutler-Hammer court case as the exception.

"If the workers believe the measuring or control devices will interfere with their own control over incentive work systems, they're pretty certain to object," an AFL-CIO official said. "If labor-management relations are favorable and the devices can be shown to reflect management's legitimate interest in getting information that will not hurt working conditions, there's no problem."

This contrasts with the "electronic spy system" label pinned on Telecontrol by Lodge 1061.

Whatever the final decision of the courts, one thing is clear: Both sides need to understand more about each other's point of view. Management needs to use these devices to reduce costs. Workers are traditionally fearful of something new, especially if they feel the system's increased efficiency could lead to layoffs or tightened earnings.

It is noteworthy that one company found that Telecontrol stabilized employment. Quicker and better production information enabled it to forecast labor needs with precision three weeks ahead. Thus, uneven work loads are balanced out with less hiring and firing.

Other advantages are becoming known to the workers and unions. Because Telecontrol keeps such complete records, there is less controversy over what caused downtime or made a job run over standard. This eliminates misunderstandings and improves labor relations.

The worker does not have to go hunting for the foreman when trouble occurs on his job. A flip of a switch summons him. This speed gives the worker greater credit for downtime. Previously, he had to walk to a time clock and punch out. Now the foreman credits the worker automatically with downtime by inserting his master key into the worker's control box. Telecontrol does the rest. This generally results in increased incentive earnings for the employee.

No doubt there is more to be heard from both sides on this subject. But in the conviction that electronic production monitoring devices are here to stay, other companies have expanded into the field: Farrington Instruments with "Productograph"; Weltronic with "Plant Central"; General Electric with "Shoptrol." Even special variations are showing up: Electronic Associates with the "Bar Chart Recorder"; K-L-A Laboratories with "Audio Automation." All these promise significant benefits for management and labor.

TELECONTROL

It's an electronic monitoring system that positions a small control box at every production station in the plant. Sensors on each machine automatically count the production of each part and signal it to a central control room. Completion of a run is signaled in the control room by a flashing green light and an audible beep. Should production stop for any reason, the machine operator flips a switch on the control box and a red light flashes in the control room. The dispatcher then notifies the foreman over the PA system to proceed to the source of the trouble.

EQUIPMENT NEWS

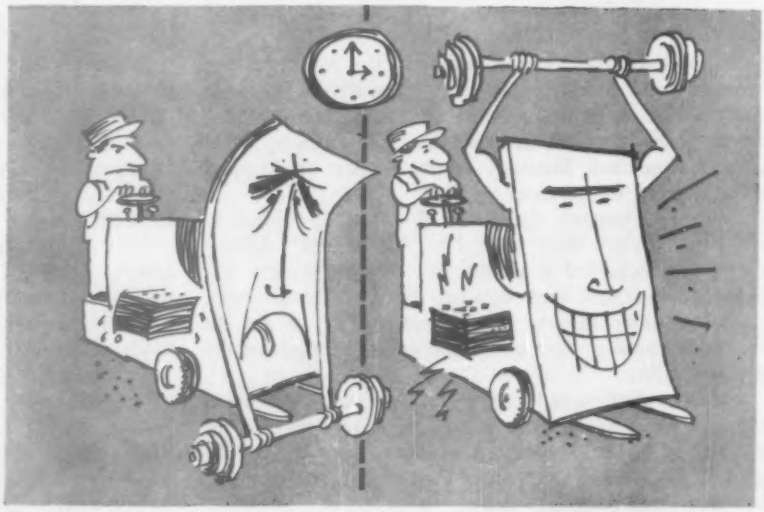
For more data, circle item numbers on Reader Service Card next to back cover.

No more 3 o'clock slump for lift trucks

You can't tell a book by its cover or a lift truck battery by its case. In the 22⅝-in.-high case (right) is a nickel-iron alkaline battery with 77% more power than previous nickel-iron batteries of same size (left).

Increased battery capacity means that small trucks in narrow aisles can handle heavier work loads all day long. Heavy-duty power attachments can now be used to increase lift speed and versatility. Fewer spares and sizes are needed.

Cost is about 80% more than for comparable lead-acid types. In five sizes, from 400 to 800 amp.hr. for up to 8000-lb. trucks. Guaranteed for life of low-lift electric hand truck. Buy or lease. *Electric Storage Battery Co.* (Circle 88)



89—Air volume computer figures cfm. in seconds for cylinders of any bore and stroke, all pressures and time cycles. Easier to use than slide rule. Eliminates guesswork and waste from over- or undersized valves, lubricators, tubing and hose. $2. *Flow Finder.*

90—Plastic fallout suit gives head-to-toe protection from radioactive dust. Sleeves end in pliable gloves, pants in reinforced shoes and shoulder strap. Clear helmet has filters for breathing. Chemicals absorb CO_2 and moisture. *Safety Clothing & Equipment Co.*

91—Radiation monitor provides continuous, spot, or automatic sampling of water supply to detect gross gamma activity. Radiation levels are printed on permanent tape. Transistorized, interchangeable plug-in modules for easy maintenance. *Nuclear Measurements Corp.*

92—Airfoil fans offer up to 91% efficiency. Have 12 blades, improved inlet cone and wheel rim design, unusual air cutoff Contoured cone permits air to enter with little shock and turbulence. No power-wasting eddies. In 24- to 89-in. fan wheel dia. *Trane Co.*

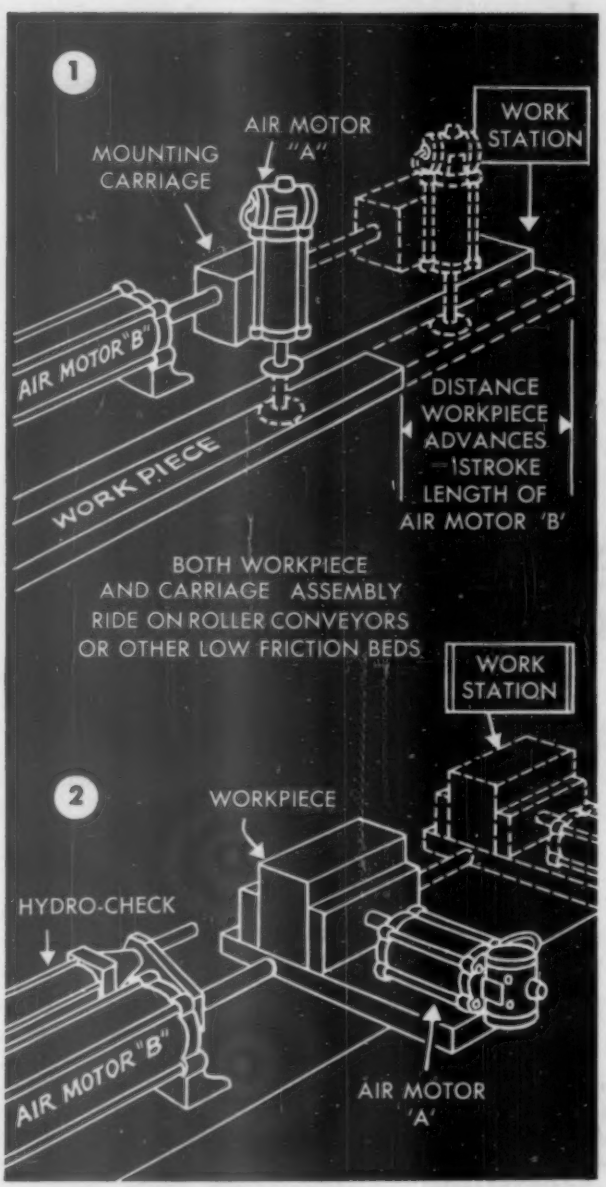
93—Pneumatic tube system carries paperwork or small tools and parts between buildings, offices or departments. Tube carriers handle up to ½-lb. load. Pre-engineered and prewired for fast installation, little maintenance. Modular design permits expansion. *Lamson Corp.*

94—Data-card file system handles business records in a volume too small to justify EDP. Coding is by flags of various colors and shapes. These are inserted in cut-outs on card's folded edge. Sorting needle lifts cards out by groups. Three sizes. *Practa Data-Card System.*

95—Tota Tray conveyor provides up to 500 ft. of work area while occupying only 250 ft. of floor space. Closely nested load-carrying pans, driven by endless chain, turn with no "bulbing" on ends. Capacity: up to 30 lb. per pan at 50 fpm. *Richards-Wilcox Mfg. Co.*

Turn the page

TWO IDEAS YOU CAN USE TO FEED AND POSITION WORK AUTOMATICALLY



In most plants today, there are few operations which present greater cost-cutting opportunities than the feeding and positioning of workpieces. Yet often this potential saving remains untapped because the high cost of special workfeeding and positioning equipment may not appear justified.

However, using Bellows Air Motors®, fast, accurate, trouble-free devices to "spot-automate" such operations can be built in your own plant—by your own men—for a fraction of the cost normally involved in such equipment. These two devices are typical:

Fig. 1, at left, shows a set-up used frequently to feed steel bar stock to a cut-off saw, to feed strip metal to a punch press, to position a strip of wood for drilling holes at regular intervals along its length, and in other applications where it is desired to alternately advance a workpiece and pause while an operation is performed. By proper positioning of work stations, it is possible to perform a sequence of operations, such as drill-and-tap, or punch , form-and-stencil.

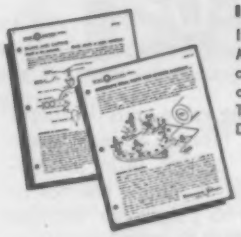
After the piston rod of Air Motor "A" has advanced to hold the workpiece, the piston rod of Air Motor "B" advances, moving carriage, Air Motor "A" and workpiece a predetermined distance forward. Workfeeder pauses while the operation is performed. Then, Air Motors retract —and the sequence is repeated.

Variations of the extremely simple set-up shown in Fig. 2 are used in virtually every industry. With the piston rod of Bellows Air Motor "A" advanced to clamp the work, Air Motor "B" advances the workpiece to the work station, pauses during the operation, then retracts. Operator unloads, reloads, and the sequence repeats. Incorporation of a Bellows Hydro-Check® provides a perfectly controlled, highly accurate feed rate, permitting this set-up's use with routers, drills, milling machines and similar equipment.

* * * *

In addition to The Bellows Air Motor, used as the "heart" of work feeding and positioning devices designed and built by creative production management everywhere, Bellows-Valvair also produces a line of Rotary and Linear Feed Tables, as well as a series of Rotary Index Tables—all completely integrated pneumatic "packaged" units including all controls and built-in wiring.

851-C



INTERESTED IN CUTTING WORKFEEDING COSTS?

If so, you'll want the special "package" we've made up. It includes a "Spot-A-Mation Idea" File, containing information on a number of different workfeeders, as well as complete information enabling you to "spot-automate" scores of other operations. In addition, we've included specs on our Rotary Feed and Index Tables and Shuttle Work Feeders. For yours—without cost or obligation—address: Dept. FA-1261, Bellows-Valvair, Akron 9, Ohio.

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For more data, circle item numbers on Reader Service Card next to back cover.

Low-cost automatic drilling for small shops

Tap-O-Matic cracks the price barrier in automatic drilling machines. For under $10,000, it puts numerically controlled drilling within reach of most small metalworking shops. Here's how it lowers your costs:

- Eliminates expensive templates.
- Cuts lead time to under one week between drawings and actual production.
- Can be set up in about 15 min.
- Accurate to ±0.0005 in.
- Drills up to 62% faster than previous models.
- Malfunction device stops machine.
- Requires no special skills to operate.
- Typist easily prepares tapes in minutes.

All this means increased production, less scrap and inspection time. And there's no need for big inventories. Tape can be quickly set up for small batch runs.

Automatic (photo), manual, and semi-automatic models. For lease or purchase on 90-day money-back guarantee. *Pratt & Whitney Co.* (Circle 96)

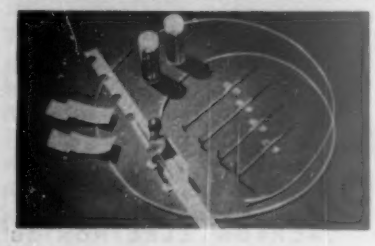
97—Pocket radiation meter measures amount of fallout at flick of switch. Operates accurately from −20 to +140 F. Low cost; performance same as large, expensive geiger counters. Three models: for industrial labs, government research, shelters. *Gelman Instrument Co.*

98—Ever-Grind ultrasonically keeps grind wheel cool and clean. Attaches to most cylindrical, centerless, and surface grinders. Prevents burning, distortion. Minimizes rejects. Permits use of finer, harder wheels for finer surface finish. *Cavitron Ultrasonics, Inc.*

99—Thermocouple, with Alnico V magnet, measures heat of magnetic surfaces quickly and accurately without damage. No need to disconnect couple from recording instrument to move from one surface to another. In any length. *Advanced Products Co.*

100—Dehumidifier, for process drying and humidity control, uses permanent desiccant. Wheel rotates through two air streams, extracting moisture from first, dries it in second (heated). Compact, uses less power than standard unit. *Cargocaire Engineering Corp.*

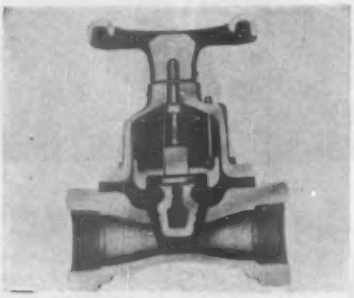
Ink kit: long on mileage, short on care



Spare your instrument man the daily time-consuming and messy job of replenishing chart recorder ink supply. Heart of Mark-Trol marking kit is replaceable cartridge and sealed capillary system. Cartridge holds ink supply for days or months. Sealed capillaries keep out dust, dirt, moisture, and mold.

Installed in less than 10 min., it can replace 90% of marking systems now in use on industrial circular chart recorders and meters.

Top photo shows cartridge being installed; bottom, the complete kit with stylus (in four sizes) and choice of five ink colors. *Esterbrook Pen Co.* (Circle 101)



102—Dia-Plug valve seals deadtight even around lumps. Linear throttling; simple design; little maintenance. For gases, fluids, slurries to 180 F., to 150 psig; also vacuum service. Choice of materials; ⅜ to 8 in. dia. *Cryogenics Corp.*

Turn the page

A TREMENDOUS BOOST AWAITS ALL PLANT EXECUTIVES AT THE 1962 PLANT ENGINEERING & MAINTENANCE SHOW & CONFERENCE • JANUARY 22-25 AT CONVENTION HALL, PHILADELPHIA, PENNSYLVANIA

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EQUIPMENT NEWS . . . Begins on page 94

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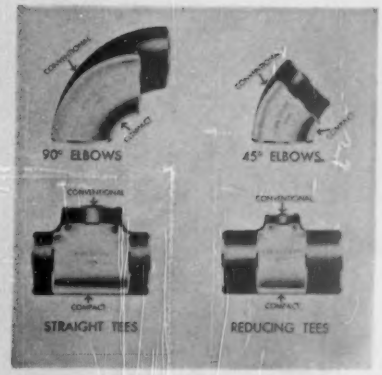
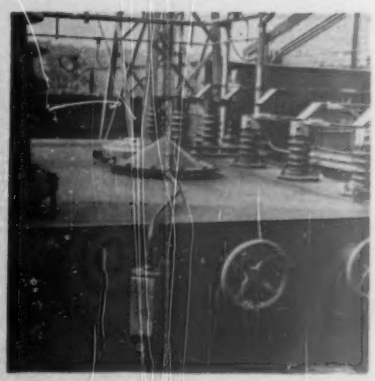


103—Compact welding fittings are lightweight; fit in tight spaces. Ends fit Schedule 40 pipe. For heating-cooling systems and low-pressure welded lines. Rated 175 psig. for water or gas; 125 psig. for steam. Complete line in 2- to 6-in. sizes. *Taylor Forge & Pipe Works.*

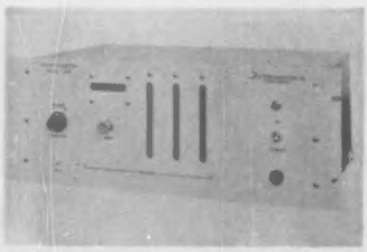
104—Automatic parking system offers cheatproof operation without attendants, low maintenance. Low gate arm stops little cars from sneaking under. Gate bar lifts with coins, tokens, coded card-keys. Instant-reversing gate control speeds traffic. *Johnson Fare Box Co.*



105—Condensing hood removes water and volatile acids from power transformers. Metallic inverted cone-shaped hood bolts to existing hand-hole in transformer cover. Hot vapors rise to hood, condense, and then drain to the outside. *Westinghouse Electric Corp.*

106—Magnetic plug, for fluid circuits and large processing tanks, holds many ferrous pieces at once. Multi-pole magnet prevents short circuit of magnetic field with one piece. In 1- to 3-in. NPT, to 8 poles with 70-lb. holding power. *Technical Development Co.*

107—Sentry-station, of durable rigid vinyl, lasts many years without aging or deterioration. All-weather structure is white. Fireproof, won't rust, rot, or corrode. Unitized construction. Custom-made in many sizes, with fixed and triple-track windows. *S & C Mfg. Co.*



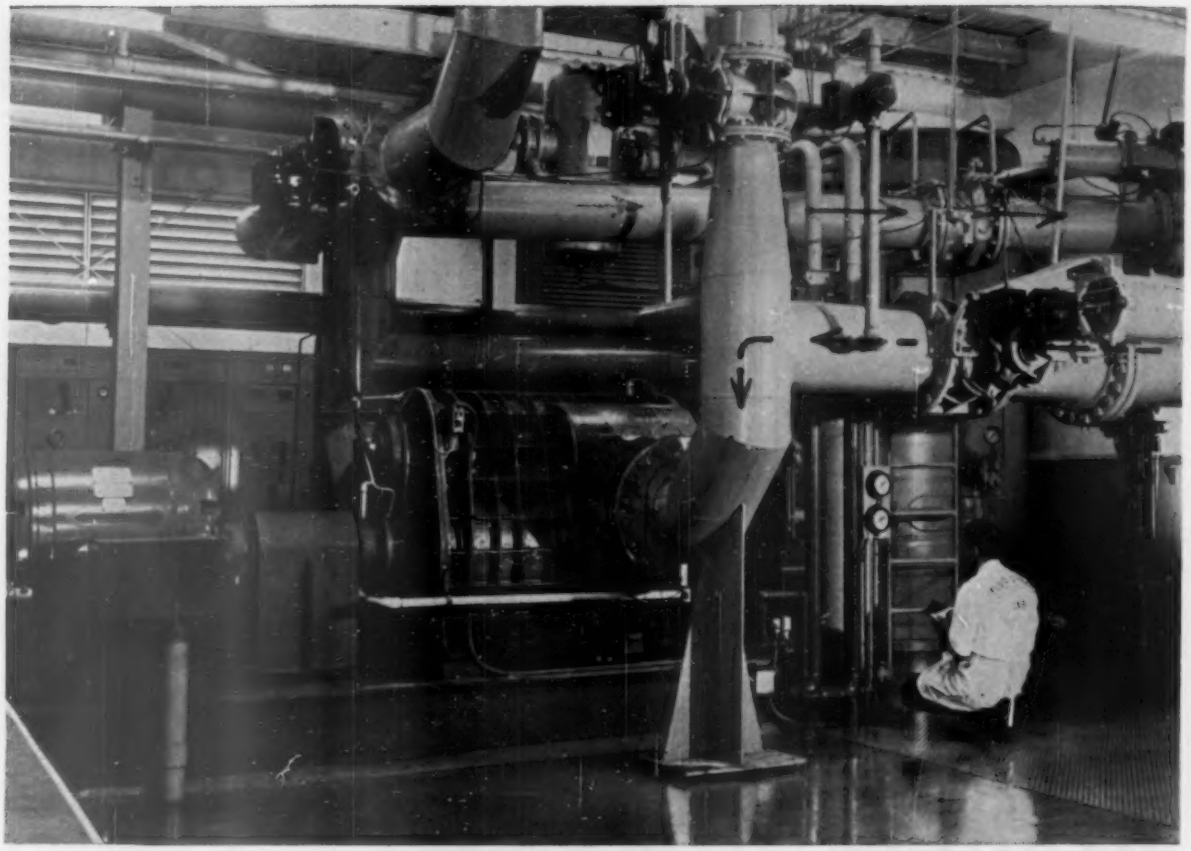
108—Event counter, when used with contact switch, photoelectric cell, or motion sensing device, reads flow or linear feet, counts production pieces, etc. High speed; 7 digits 500/sec. or 10 digits 100,000/sec. models. Needs no preamp. $245. *Avtron Mfg. Inc.*

109—Electro-mechanical control system automatically weighs, blends, or batches two or more ingredients. Simple construction permits ordinary electrician to make repairs. Automatic cut-off controls. Custom-built for delivery in 10 days. *Cardinal Scale Mfg. Co.*

110—Intercom system makes itself heard in high noise areas. Transmitter and receiver are housed in rugged, weatherproof heavy aluminum casting. Volume control and press-to-talk switch. Completely transistorized, 12 v. d-c or 117 v. a-c, 60 cycles. *Atkinson Dynamics.*

111—Portable humidity indicator gives wet or dry bulb readings close to process or in hard-to-reach spots. Compact, works accurately in any position. Comes with percentage chart of relative humidity on back side of phenolic case. Weighs under 2 lb. *Cybernetics, Inc.*

Turn the page



PRESSURE or VACUUM

The Ingersoll-Rand *Axi-compressor* provides both in a single, compact, versatile unit

USED for flight simulation at a large aircraft research center, the Ingersoll-Rand Axi-compressor shown above does double duty, serving either as a compressor or an exhauster. By switching of intake and discharge valves, it can provide up to 12,250 cfm of wind-tunnel air at 5 psig, or pull vacuums of up to 24" Hg at correspondingly high capacity.

The Axi-compressor is a positive displacement, axial-flow machine which operates by the action of two intermeshing helical rotors turning at high speed. The rotors do not touch each other or the sides of the casing—hence there is no mechanical wear and no lubrication is needed, providing a smooth flow of *oil-free* air or gas. More compact than other units of equivalent pressure and capacity, it saves both floor space and head room and can often be installed where no other compressor or vacuum pump would fit.

Type L Axi-compressors are available in 29 basic sizes, with capacities from 100 to 12,000 cfm and pressures to 15 psig or vacuums to 24" Hg. Ask your Ingersoll-Rand engineer for complete information, or send for a copy of Bulletin 11,003.

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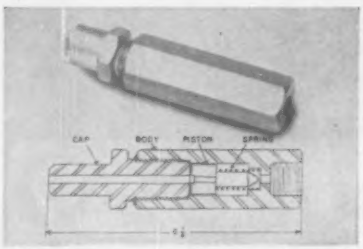
Begins on page 94

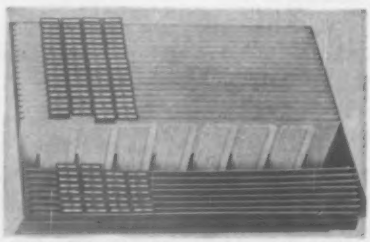
EQUIPMENT NEWS

For more data, circle item numbers on Reader Service Card next to back cover.

112—Circuit Builder permits quick changes of experimental circuits without solder or spring clips. Resistors, capacitors, etc., are connected into 108 gold-plated points by pulling up on rubber core, inserting up to 7 component pigtails and releasing. *Circuit Structures Lab.*



113—Check valve shuts instantly when flow-through exceeds pre-set rate. Eliminates hazard of sudden failure of pipe, tubing, or gauge that handles noxious, toxic, radioactive, or flammable liquid or pressurized gas. Low cost; has only two moving parts. *Chemiquip Co.*



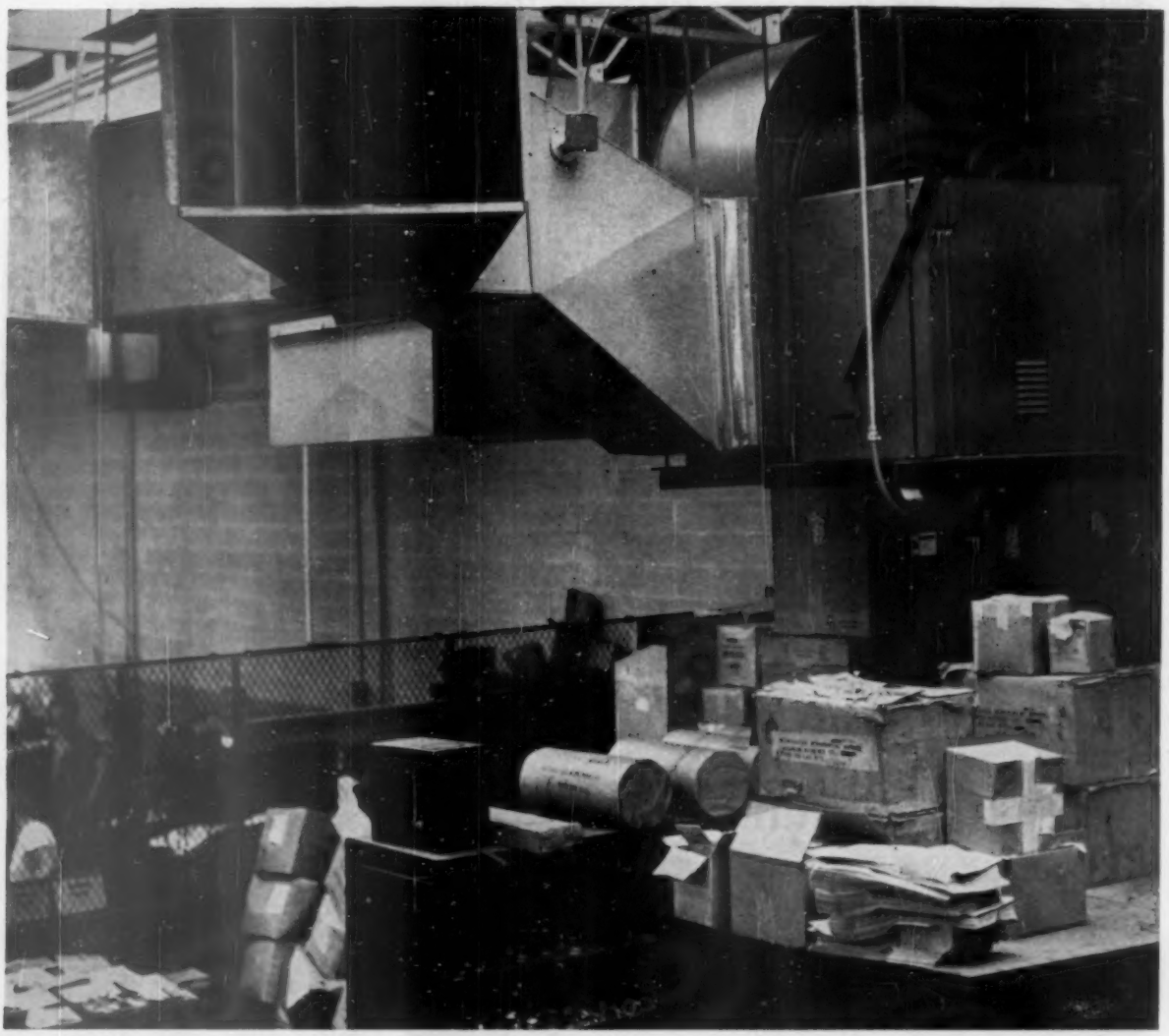
114—Visible file stores tabulating and punched cards in vertical position for fast access when cabinet is open. Minimizes card loss. Stores up to 10,000 cards in single unit, unlimited number in multiple set-up. Movable, angled index cards. *Vue-Fax System Controls Corp.*

115—Mobile vacuum cleaner filters particles to 0.3 microns with 99.97% efficiency for "white rooms" or where absolute filtration is critical. Air passes through three filters. Level control prevents motor flooding during wet pick-up. *American Cleaning Equipment Corp.*

116—Right-angle drive, in rugged steel housing, offers permanent bearing and gear alignment under heavy impact. No oil trapping; quiet, efficient. In 45 sizes, double and triple reduction; 9.39:1 to 211.0:1 ratios; to 1460 hp. *Foote Bros. Gear & Machine Corp.*

117—Limit switch, with rotating shaft, can be adjusted with one hand and screwdriver. Especially suitable for overhead door or hoist mounting where work requires step ladder. In nine ratios from 20:1 to 1280:1 with NEMA 1, 4, and 7 enclosures. *General Electric Co.*

Turn the page

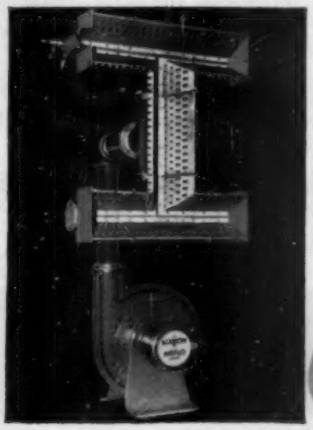


This gas-fired make-up air heater, equipped with Maxon burners, replaces exhausted air in the plant of Kiekhaefer Corporation, makers of "Mercury" outboard motors.

Cure plant air starvation with make-up air heated by GAS-fired MAXON burners

Many plants become starved for air when their exhaust systems remove air faster than it is replaced. This was the problem at Kiekhaefer Corporation of Oshkosh, Wisconsin, before they installed a gas-fired make-up air heater, equipped with Maxon AIRFLO Line Burners.

The entire plant had been under negative pressure, created by suction of exhausters at many grinding operations. This pulled downdrafts in unit heater vent flues. Workers complained of watery eyes and headaches. Condensation dripped on material. Heat loss was excessive. Maintenance cost on unit heaters became prohibitive.



Designed expressly for make-up air heating, the Maxon AIRFLO Line Burner and Mixer provide complete, odor-free combustion over very wide ranges of turn-down. They are standard equipment in many packaged heaters, and are highly recommended for heating the replacement air for paint spray booths in finishing lines.

Replacement air, heated by gas-fired Maxon Burners, solved all these problems at minimum cost. In fact, initial cost of this make-up air heater was quickly amortized on reduced maintenance and savings on fuel costs. The plant enjoys all the advantages of modern gas heat: high efficiency, precise control, speed, cleanliness, economy and dependability.

For information on heating make-up air with gas-fired Maxon burners, call your local Gas Company. Or write to Maxon Premix Burner Company, Incorporated, Muncie, Indiana.

American Gas Association

FOR HEATING MAKE-UP AIR GAS IS GOOD BUSINESS!

Buy Equipto -- Industry's choice for Quality Products

COUNT OFF!

4 1/2

128
256
512

you name it...

Equipto can supply you one, or a continuous row of customized work centers!

Thru EQUIPTO's ingenious design and method of construction, benches can easily be arranged in one continuous streamlined assembly. Additional EQUIPTO Bench Units are available, less one leg, and are easily bolted to adjoining EQUIPTO Bench. You save money on each additional bench, yet sacrifice nothing in the way of strength, convenience or appearance.

There are 264 models in stock — available with many types and styles of drawers, sliding doors, aerial shelves, and a choice of 12 ga. steel, masonite, laminated maple, or bonded wood tops.

Naturally, all drawers ride quietly on trouble-free nylon rollers. Get EQUIPTO'S complete bench story NOW. Write for complete catalog showing all 264 models.

SHELVING BENCHES DRAWER UNITS LOCKERS EQUIPTO ROBE STOCK CARTS EQUIPTO ANGLE

Equipto

For more facts Circle 446 on Reader Service Card

Begins on page 94

EQUIPMENT NEWS

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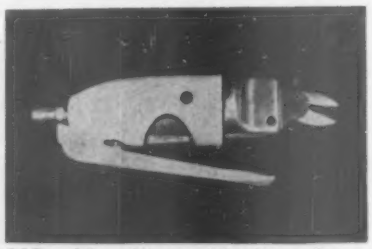
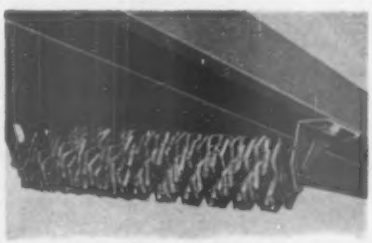


118—Air plier, with four interchangeable heads, cuts wire and plastics used in electrical and electronic components and circuits. Heads can produce square or diagonal edge, or cut and swage at same time. Low maintenance. Weighs under ½ lb. *Rotor Tool Co.*

119—Dial indicator, 3¼-in. face, offers 2500:1 magnification and 0.000050-in. graduations. Accurate over full AGD range of 0.010 in. Resists shock from both directions. Micro-finish surfaces reduce friction to one-quarter of standard type. *Federal Products Corp.*

120—Fluorescent fixture line is rugged, yet trim in appearance. Easy to install and service, fixtures adapt to 430-ma. rapid start and instant start lamps, 800-ma. high output rapid start and all types of 1500-ma. extra high output. *Sylvania Electric Products Inc.*



121—Belt-cleaning idler is used on conveyors handling wet, sticky, or frozen ores, sand, lime, clay, coal. Resilient; removes and rejects granular materials as it turns. Needs no power. In all belt widths, has 6-in. diameter rolls, ¾-in. bearings. *Webster Mfg., Inc.*

Turn the page

FOOD FOR THOUGHT

NOW! New food service versatility from Canteen®

CounterVend: the unique combination of a cafeteria COUNTER and automatic VENDING machines to meet the need for fast, low-cost, in-plant food service

This spectacular new development from Automatic Canteen solves management's two most vexing in-plant food service problems: keeping employee satisfaction high, yet reducing costs sharply.

CounterVend,* as the name implies, offers the *personal* attention of counter service with the *speed* and *selectivity* of automatic vending. The variety of menus is pleasingly wide. Included are expertly prepared hot and cold food, pastries, desserts and beverages, as well as cigarettes, candy and gum.

The cafeteria section consists of an efficient food preparation area; refrigerated and heated, self-service cabinets and storage compartments; an automatic "cashier." The bank of ultra-modern vending machines completes the CounterVend unit which is prefabricated and readily adapts to varying space conditions.

The CounterVend unit is owned, staffed and maintained by Canteen. This means telling savings for it eliminates investment in kitchen and serving equipment and removes the overhead burden of supervisory and service personnel.

*T.M.

CAFETERIA CATERING • ERVEND VENDED FOOD SERVICE

AUTOMATIC CANTEEN

AUTOMATIC CANTEEN COMPANY OF AMERICA

Canteen Food Service Division will gladly demonstrate how CounterVend can meet your specific requirements. For prompt, complete information mail the coupon.

Food Service Division
Automatic Canteen Company of America
The Merchandise Mart
Chicago 54, Illinois

Gentlemen:
We are interested in knowing more about Canteen CounterVend.

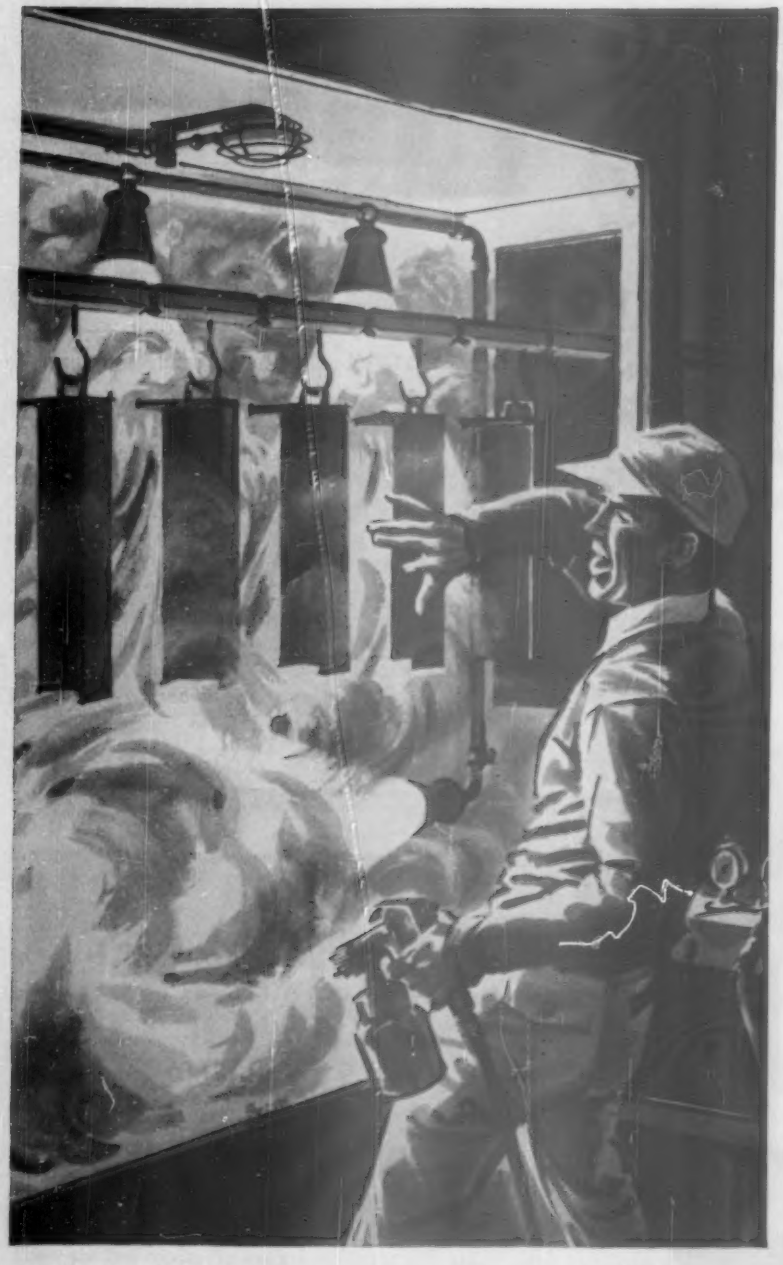
Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

For more facts Circle 447 on Reader Service Card



Killing blow! It takes only minutes for fire to burn your business to a crisp. Guard against the danger of a crippling flammable-liquid fire (as in the spray booth above) with a *fully automatic* Kidde carbon dioxide extinguishing system. Approved by U.L. and F.M., Kidde systems smother flammable-liquid and electrical fires in seconds, leave no mess, turn off power and sound alarms... get you back in production fast. Kidde's 35 years of experience can help you protect any hazard. Write Kidde today and find out how.

Industrial and Marine Division
Walter Kidde & Company, Inc.
1244 Main St., Belleville 9, N. J.

Kidde

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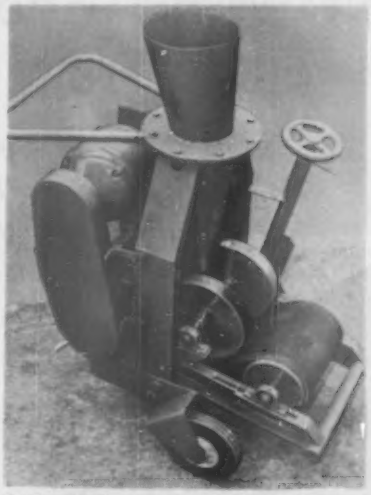


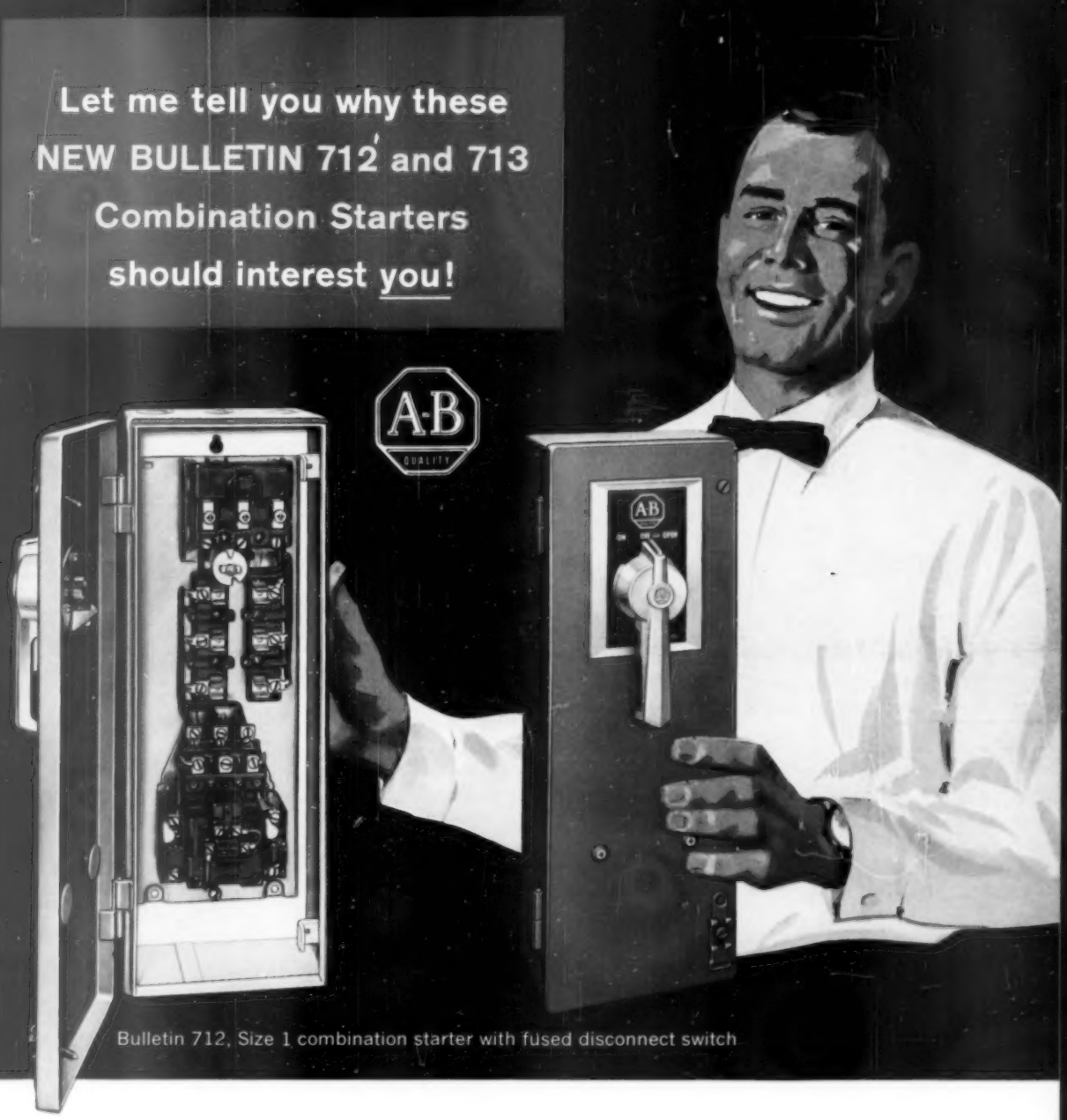
122—Bulk material loader piles dry, free-flowing granules or lumps to 2-in. dia., in flat storage areas, boxcars, bins. Spout is fed from fixed or portable overhead conveying equipment. Handles up to 8600 cfh.; 50-ft. throwing radius. *Ft. Worth Steel & Machinery Co.*

123—Dry dust filter permits removal of individual cage and sock assemblies for replacement with completely assembled spare units. Reduces downtime, eliminates dust leakage around bag frames. Horizontal design is suitable for limited headroom. *Young Machinery Co.*

124—Automatic stop clock measures intervals down to 1/100 sec. Can be started, stopped, and reset remotely. Full dial re-set in about 100 milliseconds. Cone clutch engages pointer mechanism with synchronous motor in 20 to 40 milliseconds. *Industrial Timer Corp.*

Turn the page

Let me tell you why these NEW BULLETIN 712 and 713 Combination Starters should interest you!



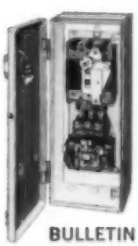
Bulletin 712, Size 1 combination starter with fused disconnect switch

They have — Smaller Size...Greater Switching Capacity... Greater Reliability...Longer Life...Complete Safety... Generous Wiring Room...Simple Design...Businesslike Beauty

Rating for rating, the new Bulletin 712 motor starter will outperform and outlast all others. Complete safety for the operator is assured because the cabinet door cannot be opened until the lever is moved to the OPEN position, which opens the visible contact disconnect switch.

The Bulletin 713 combination starter provides similar features for complete safety, but uses an ITE circuit breaker as a method of disconnecting.

Brooks Stevens, famous industrial designer, has given the entire line of enclosures, an undeniable "eye appeal"—an asset to any modern machine tool or industrial installation. Please write for details, in Publication 6100: Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wis.



BULLETIN 713
Combination Starter with Circuit Breaker in Nema Type 1 Enclosure.

19-61-RM

ALLEN-BRADLEY

Member of NEMA

QUALITY
MOTOR CONTROL

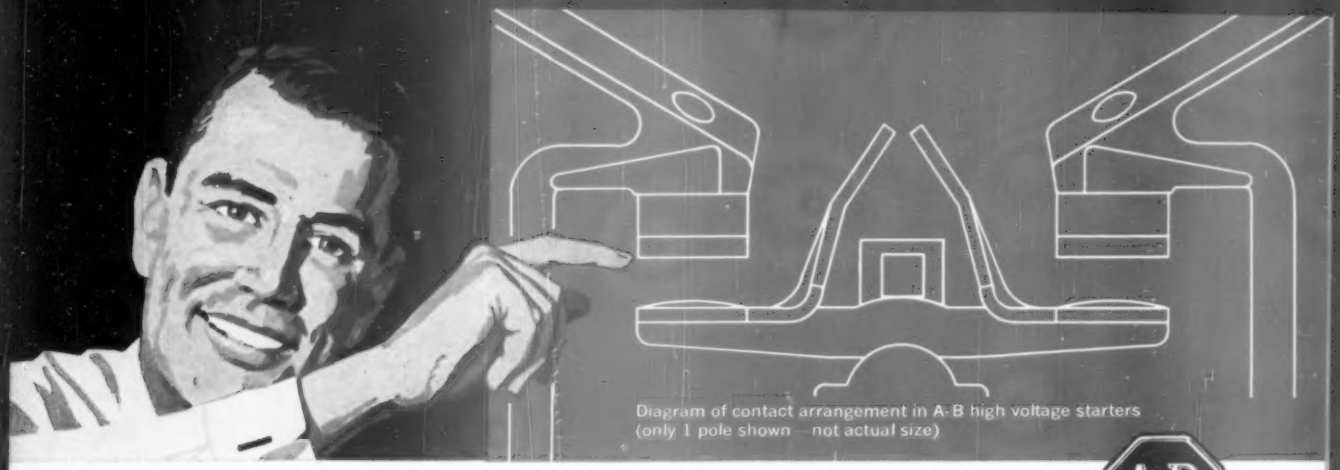


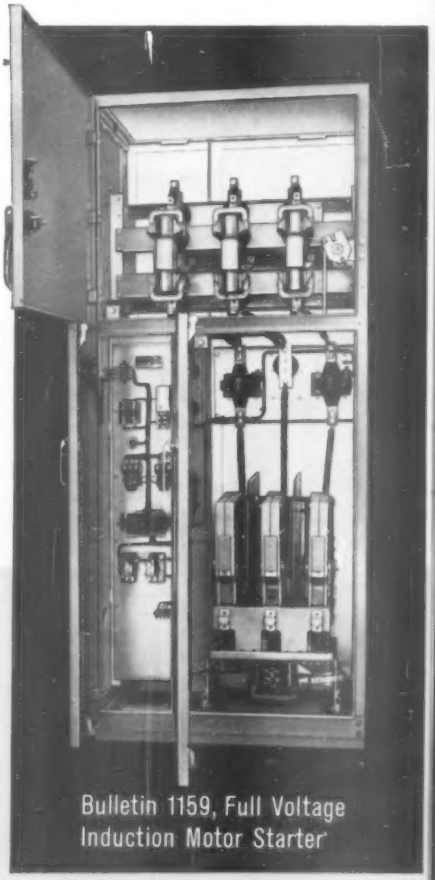
Diagram of contact arrangement in A-B high voltage starters
(only 1 pole shown—not actual size)

Would You Believe That

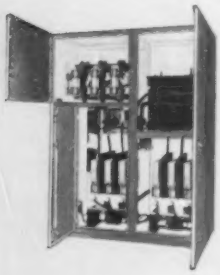
3/8 OF AN INCH IS THE REASON

for the Reliability and Long Trouble Free Life of A-B Starters Rated at 1500 hp, 2300 v; 2500 hp, 4600 v!

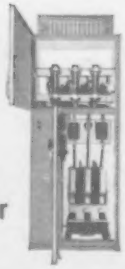
Allen-Bradley high voltage starters were designed and are built to provide millions of trouble free operations. An astounding claim—for this class of apparatus—but *true!* The extraordinary performance of the air break contacts is the result of extremely short contact travel—only 3/8"! Naturally, such short travel reduces pounding and contact wear to a minimum. Also, the famous Allen-Bradley solenoid principle of operation is so simple that nothing can go wrong. Maintenance-free, double break silver alloy contacts are used throughout. Allen-Bradley high voltage starters are available for all types of motors and all types of service. For full details please write today for Bulletin 6080 to: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.



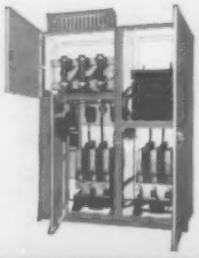
Bulletin 1159, Full Voltage
Induction Motor Starter



Bulletin 1172, Reduced Voltage
Induction Motor Starter



Bulletin 966, Full Voltage
Synchronous Motor Starter



Bulletin 983, Reduced Voltage
Synchronous Motor Starter

19-61-RM

ALLEN-BRADLEY

QUALITY
MOTOR CONTROL

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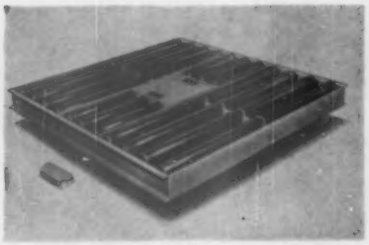

125—Pneumatic lift turntable fits into roller conveyor system to change flow direction. Power-lifts conveyor section with load, then manually rotates and lowers. In 3-, 4-, 5-sq.-ft. sections; latter has 2500-lb. lift capacity at 80 psi. *Specialty Equipment Corp.*

126—Overhead conveyor trolley, with Teflon-sealed ball bearing wheels (photo), is suitable where grease or oil dripping could cause damage. Teflon seals assure rollability at room or medium oven temperatures. Permanently lubricated wheels. *American MonoRail Co.*

127—Fluorescent fixture, with special prismatic lens on bottom and plastic panels on sides, is completely luminous. Four- or 8-ft. Cleer-vue can be surface-mounted singly or in rows. One-piece enclosure opens from both sides without tools. *Westinghouse Electric Corp.*

Turn the page

Find your man in 9 seconds...

dial...

talk...

■ Your man is "somewhere in the building" and you need him fast. How much time do you waste before you can talk to him? Multiply your needs by others who must reach a maintenance man...a production supervisor ...an engineer...any of the vital men-on-the-go who keep your operations humming.

Now, in just 9 seconds you can "pinpoint" your man anywhere—in a noisy location or a quiet one—talk to him privately. With Motorola Radio Paging, problems are taken care of *almost as soon as they arise!* Ask for on-the-job proof...of performance in and around the building or city-wide ...of savings which often return entire system cost in a few months. Contact Motorola today. Write Dept. AFT 149.

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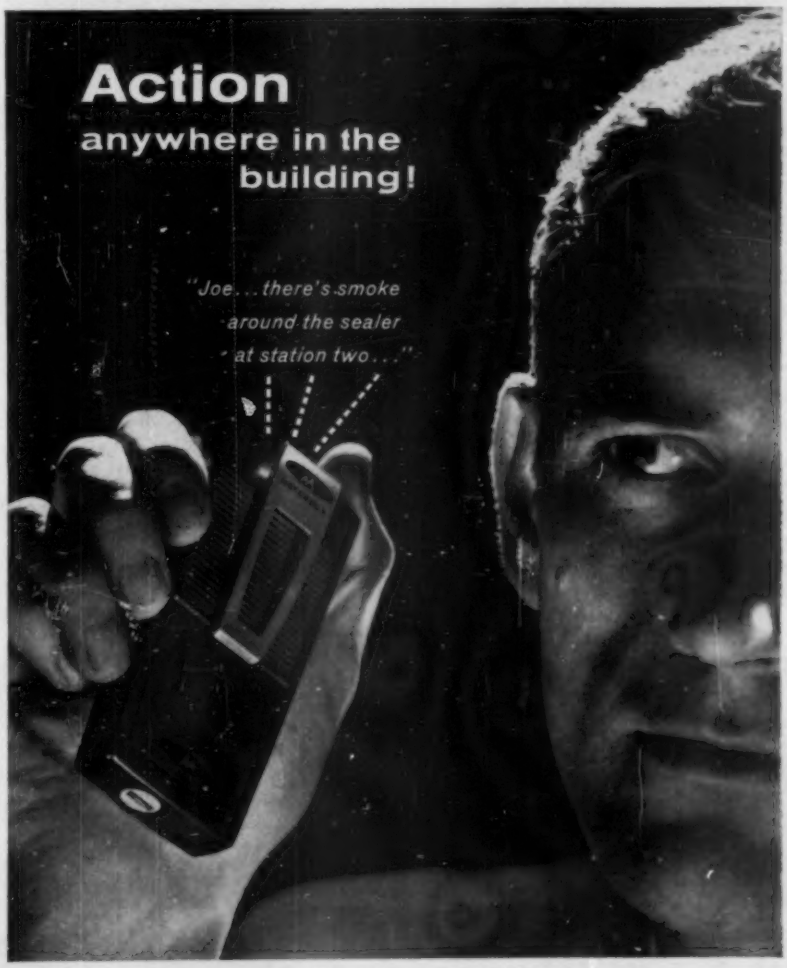

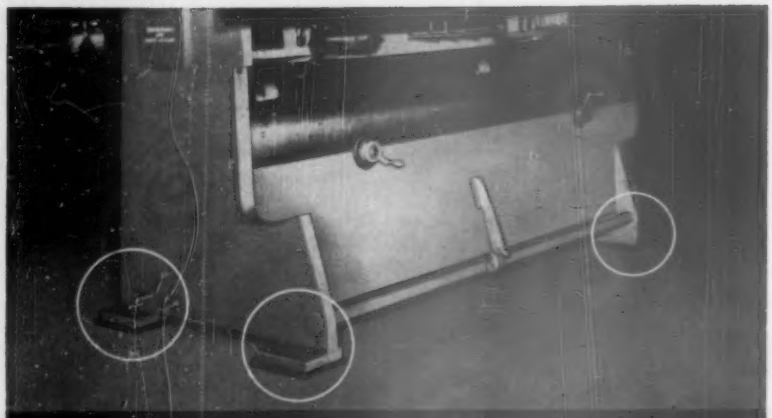

YOUR UNISORB DISTRIBUTOR

Can help your machines get a More Productive Foothold!

Do you have any of these problems: Big press or other machine to relocate quickly, inexpensively? Prevention of transmitted vibration . . . induced vibration? Irregular plant floors?

If so, call in the Unisorb distributor. He knows Unisorb mounts can cut machine installation time up to 80% . . . prevent up to 85% transmitted vibration . . . control induced vibration . . . level machines quickly . . . muffle noise.

He knows Unisorb-mounted machines produce more efficiently. Equipment can run at higher speeds — production increases. Workers do a better job, are less fatigued when noise is controlled.

Machine alignment is improved, too: fewer replacement parts are necessary, tolerances are easier to hold. Maintenance of structures is lowered, floors are not damaged by drilling (no lag bolts nor screws are needed).

ASK YOUR DISTRIBUTOR ABOUT

UNISORB PADS
The basic vibration control unit. Many densities, thicknesses. Have successfully mounted machines up to 275,000 pounds.

UNISORB LEVEL-RITE "200" and "500"
Support maximum loads of up to 750 lbs. per unit. Low cost, precise leveling and vibration control for light and medium-duty machines.

UNISORB LEVEL-RITE
Universal self contained leveling device for all types of machines. Available in a family of products to support maximum loads of up to 7500 lbs. per unit. Fast, easy, precise leveling. Available with exclusive screw-post design or as a basic mounting plate for built-in leveling devices.

SEND FOR FREE SAMPLE AND NAME OF DISTRIBUTOR NEAREST YOU

UNISORB

Division of The FELTERS Company
UNISORB 206 SOUTH STREET, BOSTON 11, MASSACHUSETTS

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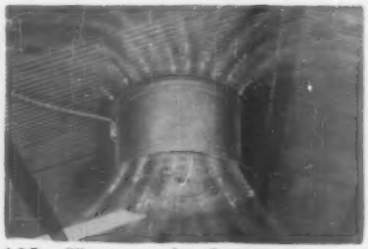
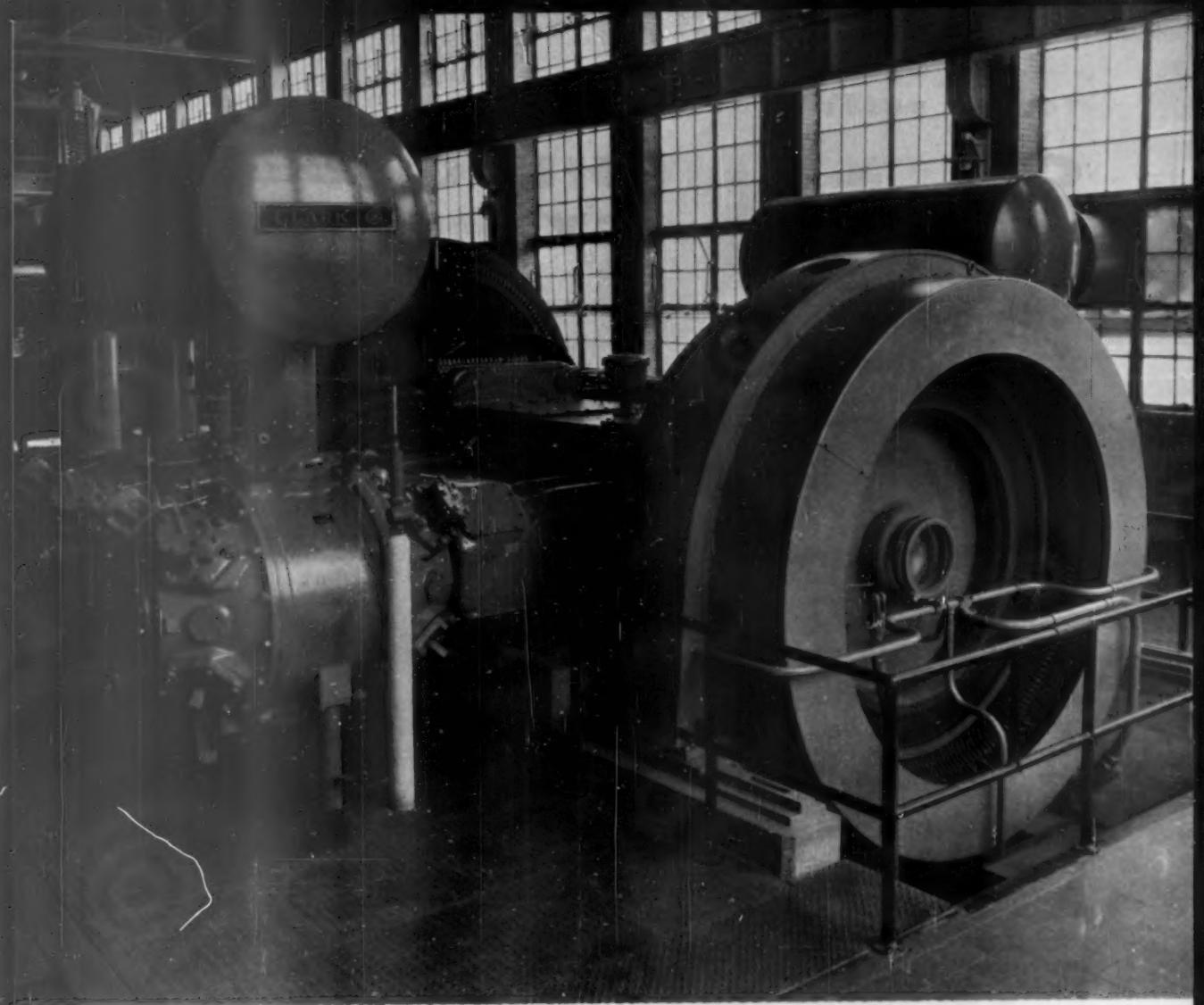


128—Heat recirculator recovers heat normally trapped under roof line and returns it to floor area. Motor-operated fan pulls heat into top of unit, diffuses it down through conical openings. Wide floor coverage. Easy to install. In 280 to 30,000 cfm. *Genie-Air Products.*

129—Variable speed transmission, ⅛ to 1½ hp., delivers backward or reverse speeds from maximum to zero. Built-in overload protection. Design prevents lost motion, backlash; increases power 10% over previous models. Speed adjustment: ¼₀₀₀. *Graham Transmissions Inc.*

130—Electronic gauging console, part of new line of gauging apparatus, automatically reads and prints out up to 24-gauge positions in a minute. Small probes permit checking hard-to-reach and out-of-sight interiors of hollow parts. Accurate to 0.0001 in. *Winslow Mfg. Co.*

Turn the page



Clark Air Compressor Keeps Lid On Maintenance!

Just Plain Dependable—That's the only way to describe this 2000 bhp Clark CBA-4 Balanced/Opposed Compressor. Ten years ago it was installed in the assembly plant of a major Detroit automotive manufacturer. To date, there has been no forced downtime other than scheduled maintenance overhauls.

On Duty 16 Hours a Day, five days a week, the compressor operates as a base load machine supplying 10,000 cfm of air at 105 psi. This is rated at 8% of total plant air utilized to operate the assembly line, paint shops, glass plant, blast furnaces and other functions.

Under a Preventive Maintenance Program, the compressor is overhauled once every two years. After 10 years of service, the valves are still original equipment. Bearings are also original equipment and have required no maintenance since startup.

Besides this Trouble-Free Performance, the user is on the "plus" side in many other respects. Among them: Smooth operation achieved by Clark Balanced/Opposed design; compactness that saves floorspace; simplified, reduced foundation requirements; inherent accessibility; marked simplicity of design.

Covering a Range of 75-8000 BHP, the Clark Balanced/Opposed, Motor-Driven line is increasingly becoming industry's preference for plant air requirements. Complete details are obtainable in Bulletin 185. Write now for your copy or get the facts first hand from your nearest Clark representative.

ROOTS CONNERSVILLE — Blowers, Compressors, Gas Pumps, Rootsmeters, Vacuum Blowers

Working together in allied industries . . .

PODBIELNIAK — Centrifugal Contactors, Distillation Apparatus, Instrumentation

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OIL • GAS • CHEMICAL
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Engines • Compressors
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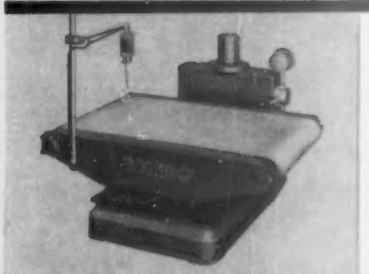
TOLEDO BRINGS YOU UNCHALLENGED

CHECKWEIGHING ACCURACY

Model 9457 for small packages
2 oz. to 50 oz. capacity

Model 9463 for intermediate size packages
2 lb. to 25 lb. capacity



Model 9460 for heavy-duty
25 lb. to 250 lb. capacity

Model 9465 for items of exceptional length
10 lb. to 100 lb. capacity

Exclusive TOLEDO phase-sensitive, plug-in amplifiers are totally unaffected by voltage fluctuations . . . assure repeatable accuracy

Now you can have full-time protection against under-weight packages, customer complaints and restrictions on product sales. Put a Toledo 100% In-line Checkweigher on the job. New phase-sensitive amplifiers, an exclusive Toledo development, maintain stable operation independent of plant voltage fluctuations.

Toledo Checkweighers reflect the *most advanced* concepts of scale, material handling, and control engineering. They are compact, free of complex mechanisms and fit easily into most of the widely used conveyor systems. Zone Edge Tolerance is ±1/32 oz. in smaller capacity units to ±¼ oz. in larger models.

FOR VALUABLE INFORMATION ON TOLEDO CHECKWEIGHERS, AND RELATED ACCESSORIES, ASK FOR BULLETIN 2968.

TOLEDO® *Prime source for weighing technology and equipment*

TOLEDO SCALE, Division of Toledo Scale Corporation, 1401 Telegraph Rd. Toledo 12, Ohio

(TOLEDO SCALE CO. OF CANADA, LTD., WINDSOR, ONTARIO)

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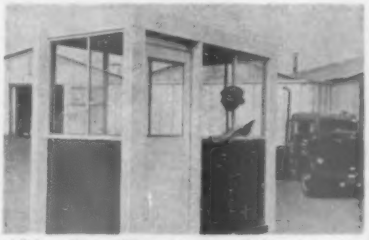

131—Guardhouse or gatehouse provides clear-round visibility plus weather protection. Each wall has sliding aluminum window. Exterior panels are faced with porcelain enamel on steel. Comes in 10 colors, 3 sizes from 4x4 to 4x8 ft. Completely wired. *Erie Enameling Co.*

132—Infra-red space heater, gas-fired, produces to 40,000 Btu./hr. Directs heat straight down to personnel in work areas or for process drying, etc. Lightweight, for suspension from existing trusswork. No moving parts; instantaneous warm-up; quiet. *Dravo Corp.*

133—Emergency generator supplies 750 va. at 115 v. 60 cycles within 50 milliseconds after lines fail. Senses line failure, automatically transfers load to output of inverter at instant of failure. Requires 120 v. battery source. *Federal Pacific & Electric Co.*

134—Flow valve is made from one length of silicone rubber tubing nested within another and clamped at each end to form pressure-tight annular space between. Pneumatic or hydraulic pressure in interspace closes inner tube. Seals tight even with lumps. *D. M. Connor & Co.*

Turn the page

LINK-BELT Parallel Shaft Speed Reducers

rarin' to go where the going is roughest!

SINGLE REDUCTION

DOUBLE REDUCTION

TRIPLE REDUCTION

57 RUGGED, COMPACT SIZES!

Link-Belt parallel shaft speed reducers are built for continuous duty under the most punishing operating conditions. They easily withstand heavy shock loads and temporary overloads . . . ignore moist or abrasive atmospheres.

Herringbone or double helical gears are arranged in a "balanced" design that permits high-hp, high-ratio reduction. Sturdy, reinforced cast iron or welded steel housings keep parts accurately and permanently aligned. All have outstanding features, including positive splash lubrication, magnetic drain plugs, high-capacity spherical roller bearings and unique grease-lubricated seals.

Link-Belt offers 40 sizes of double and triple reduction units . . . 17 single. This wide selection permits close matching of hp requirements . . . holds your drive costs to a minimum.

ASK OUR ENGINEERS!

Our experienced field engineers will help you with your application problems. With industry's *most complete* speed reducer line to work with, their recommendations are unrestricted, unbiased. Contact your nearest Link-Belt office or authorized distributor. Ask for Book 2719.

LINK-BELT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World. 15,585

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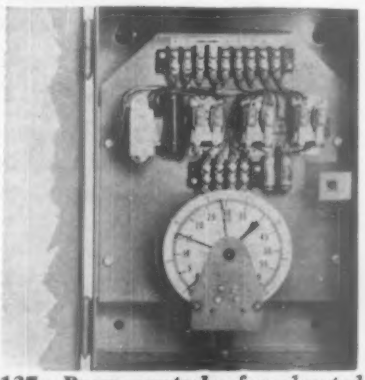
EQUIPMENT NEWS

For more data, circle item numbers you want on Reader Service Card.

135—Elevator hopper automatically unscrambles, counts, and feeds valve assemblies, screws (to 8 in. long), other parts in various sizes and shapes. No need to change over for different sizes or parts. Feeds up to 1000 pieces/min. Adjustable discharge. *Count-O-Matic, Inc.*

136—Air filter has permanent element and self-cleaning device which removes solids from surface. Handles constant high air volume with uniformly low resistance. Filter elements available for individual needs. Fits over existing filter housings. *Honan Associates, Inc.*



137—Pump controls, for elevated or pressure tanks, combine control and indication at low price. Easy to install and operate. Electrically isolated pointer triggers control as it indicates pressure variations. No trial settings; gauge sets in 2 sec. *Automatic Control Co.*

POWASERT
Puts the Fastener First!

NEW Powasert feeder with continuous raceway, smooth-action feeder tray.

POWASERT is the automatic nailer that drives genuine nails — the kind you choose when you drive by hand. Either lowest cost common, or highest holding threaded nails. It drives them fast — up to six times faster than a man with a hammer.

You just dump bulk nails into the versatile Feeder and the POWASERT Nailer puts them *where* you want them...the *way* you want them. Why pay premium prices for substitute fasteners when nails do the job cheaper and better?

You get added economy, too, because POWASERT reduces fastener waste and product damage. For high speed, high profit NAILING, don't compromise on quality of fastener or fastening job. Get POWASERT. Write for facts on what it is doing in your own industry. Powasert, United Shoe Machinery Corporation, Boston 10, Mass.

United
POWASERT®
THE AUTOMATIC WAY TO FASTENING SPEED AND SAVINGS

For more facts Circle 455 on Reader Service Card

How many of these 12 losses can you cut with Penco-Planned shelving & lockers?

- ☐ Product Damage
- ☐ Excessive Handling Costs
- ☐ Waste Space
- ☐ Slow Order-filling
- ☐ Poor Inventory Control
- ☐ Insurance Costs
- ☐ Pilfering
- ☐ Accidents
- ☐ Production Bottlenecks
- ☐ Shipping Bottlenecks
- ☐ Plant Cleaning Costs
- ☐ Low Employee Morale

If your company is considering new shelving and lockers, look into Penco Planning before you buy. Your Penco representative can show you how Penco units can be used to control *up to 12 major drains on efficiency and profitability* . . . if your operations and requirements are studied in advance. Re-check the list above! The secret is not how many units you buy, but how well units are integrated into your operations as functional systems. Check the Penco installations shown here. Then get more details in our free booklet "12 Losses Penco Planning Can Control". It's filled with slants on how to make storage facilities pay off. Finally, before you buy any lockers or shelving, call your nearby Penco dealer for advice and for fast, efficient service.

One look tells you that these Penco-Planned lockers step up employee morale, cut housekeeping costs.

New Penco T-Line boltless shelving above covers 48,000 sq. ft. . . . speeds handling of 15,000 production items. It simplifies inventory of parts in process, and permits fast changes of layout. No tools are required.

SEND FOR THIS FREE BOOKLET TODAY

ALAN WOOD STEEL COMPANY
PENCO DIVISION 424 Brower Ave., Oaks, Pennsylvania

Please send free booklet, "12 Losses Penco Planning Can Control." (No obligation, of course.)

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Please send also: ☐ General Shelving Catalog ☐ General Locker Catalog

Inventory Management Simulator program at...

Clark Equipment... improves custome

■ **High-capacity memory.** Two IBM 305 Data Processing Systems with RAMAC keep track of 75,000 replacement and repair parts in Clark's Chicago parts warehouse. ■ **The computer has the facts.** As soon as shipments arrive at the warehouse, an operator, using this remote inquiry station near the loading platform, finds out from the computers where various items go. ■ **Customer service first.** Using this remote inquiry station in the sales department, the operator gets information from the computer while the customer is on the phone.

Clark Equipment Company has prepared a cor puter program called an Inventory Manag ment Simulator. The program allows Cla management to study the possible effects of d cisions on future customer service and futu warehouse profitability. When manageme gets the computer's report, it is in a position make new rules for the operation of its par warehouse.

Here's what's happened since Clark put t new program into operation:... improved cu tomer service... practically eliminated bac order problem . . . reduced the putaway tir for incoming material by more than 50 per ce ... reduced emergency order shipping time 50 per cent... enabled a physical inventory be taken without any interruption of servi to customers.

ervice...with less inventory

lability highest ever. Inventory management complex job at Clark. Its Chicago ware- se is one of the busiest and largest in the ntry. Before the Simulator program was eloped, the warehouse carried an inventory 5,000 individual replacement and repair s. Use of the program helped transfer the stment in inventory to those parts most uently called for, giving high availability less investment.

agement Operating System.* Clark installed IBM 305 Data Processing Systems with AC.® These computers store, update, and on an instant's notice information on al- every aspect of the warehouse operation ding complete information on every one of 75,000 items maintained in stock.

ow, Clark is assured of maintaining just the right level of stock for each item. The procurement formulas, developed from the Inventory Management Simulator, even recommend how large a purchase order should be placed for each item and where it should be placed.

If you have an inventory problem, why not consider a simulation program? You don't have to have your own computer. We can supply you with an Inventory Management Simulator...you can rent time on a computer. Result...improve the profitability of your warehouse operation.

**A Management Operating System uses IBM computers to make routine business decisions and take action automatically ...flags problems that need management's special attention... frees management to concentrate on the big problems and on long range planning. As a result, it gives tighter control of all business operations...and helps cut costs.*

IBM®
DATA PROCESSING

For more facts Circle 457 on Reader Service Card

HUMAN RELATIONS

By Vivian Lunardi Assistant Editor, FACTORY

Blackball thwarts thieves

Managers, are you willing to gamble to reduce pilferage among employes? If it's a ticklish and thorny problem at your plant, here's a painless way to reduce it almost to zero. And with no accusations or recriminations. All you need is a gumball machine with black and white pellets, suggests Solar Light Manufacturing Company, Chicago.

Place it at the plant gate with a guard at the controls. At quitting time, each car stops at the machine as the guard turns the handle. White you win, black you lose. Loss means a complete check-up of the car and occupants for plant materials. Uncertainty can make honest men of shoplifters.

Tension, yes; worry, no

Worry won't kill you if you face problems squarely and solve them. But sidetrack those problems and internal tensions increase. Repression of our natural safety valves cause these tensions to find outlets in the stomach, heart, blood vessels, etc. And this will eventually kill you, says Dr. Gerald Gordon, chief psychiatrist at E. I. du Pont de Nemours and Company, Wilmington, Del.

What are these emotional safety valves? Fear and anger to name but two. Both are taboo in today's society despite their being quite normal emotions, Gordon points out. Most men consider such emotions as weaknesses to be scorned. Since childhood, they are taught to believe that only sissies cry, cowards fear, and rash men lose their heads.

In business, this unnatural attitude takes its toll. A supervisor smiles and retreats instead of delivering a deserved tongue-lashing. He dismisses problems to avoid emotional upsets. He makes everybody happy while feeding his ulcers.

Dr. Gordon suggests this solution: Admit that life is a conflict. Then discipline yourself to meet problems head-on. Don't try to spread joy among your subordinates. Rather be direct, accurate, and honest about their job performances, even though some may be hurt in the process. Once the problem is off your chest, fears and guilt about not fulfilling your job obligations will disappear. This brings about a natural relaxation of tensions and consequently fewer pills in the desk drawer.

Retraining not boss's job

"Crash" retraining is the least efficient way to solve the problem of displaced workers. It's up to the worker himself to acquire extra skills long before becoming unemployed, says Ross J. Wilhelm, University of Michigan (Ann Arbor) economist.

People, like products, can become obsolete. To guard against this, the individual must keep himself technically and psychologically ready for the next job. This is not a responsibility of government or industry but of every worker, concludes Wilhelm.

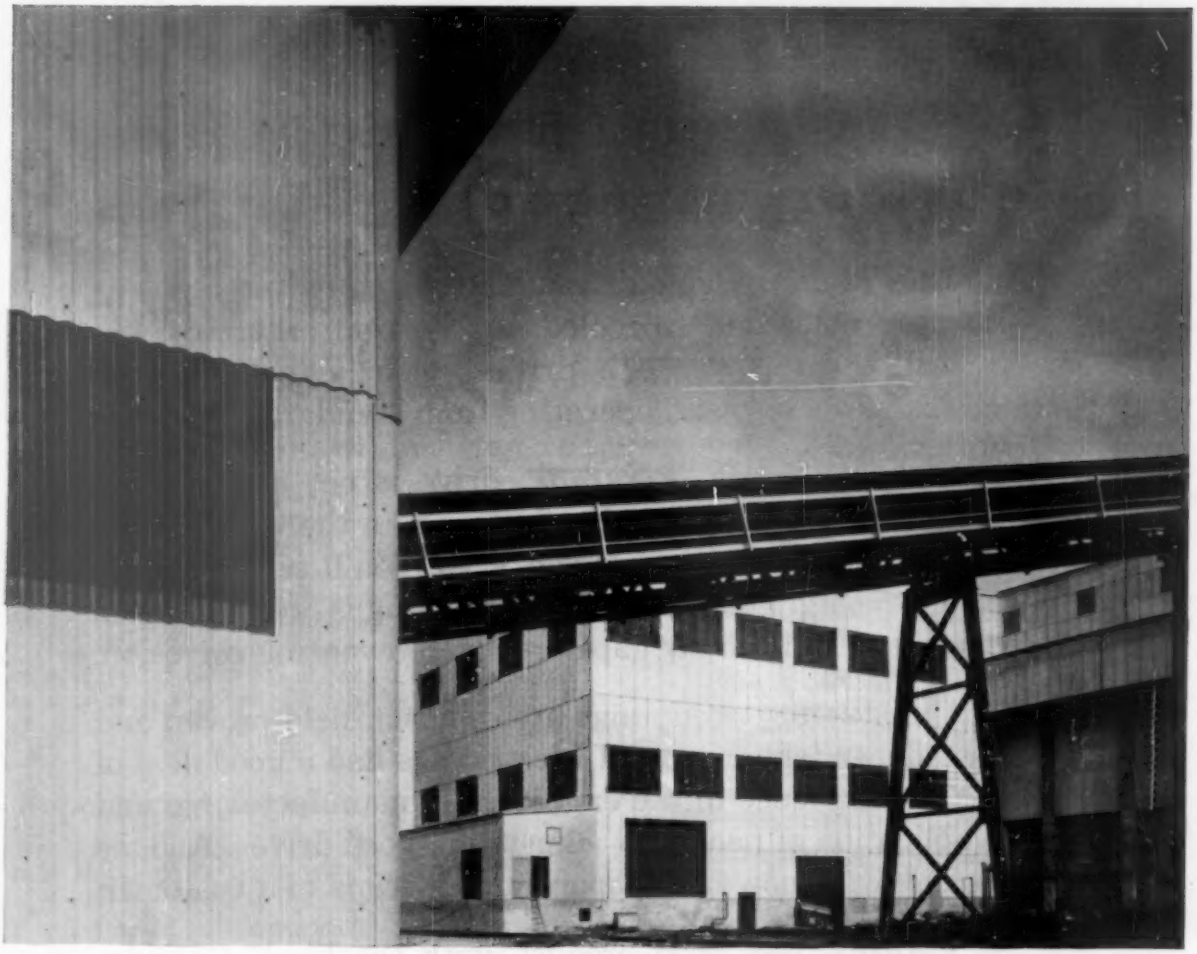
T&M study bites the dust

It isn't always a snap to take a lady's picture. So General Electric Company found out when 18 workers walked out of its Louisville, Ky., plant to protest the photographing of a woman worker.

The camera-shy lady was to be chief protagonist in a movie of time-motion studies. But she was temperamentally unprepared for the photographer's prodding. Her plight rallied enough sympathy from fellow workers to cause a one-day layoff of 1100 other employees until production could be returned to normal.

An injunction against G-E by Local 761, International Union of Electrical Workers, provided this fadeout: No more photos of women employees.

Turn the page



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J-M CORRULUX IS an economically-priced, translucent building panel manufactured by Johns-Manville. It is made of weather-resistant, light-stabilized resins reinforced with high strength Johns-Manville fiber glass. Corrulux panels are noted for their shatterproof strength, resistance to industrial fumes, easy installation, long life and exceptional light admission.

J-M CORRULUX HELPS INCREASE EFFICIENCY. Although Corrulux admits up to 80% of the light striking it, the light is diffused. There is no glare to cause worker eyestrain. Transmission of sun heat is also reduced—a boon on hot summer days. A soft green color was chosen for the plant above. But there are 17 other colors, with varying light transmission qualities, for you to choose from.

J-M CORRULUX WORKS EASILY, CUTS COSTS. Exterior framing can be eliminated (see panel at left of photograph) because Corrulux panels handle as easily as the panels of J-M Corrugated Transite® which are used for the exterior walls of this plant. And when framing *is* required, Corrulux reduces it to a low-cost minimum. Corrulux can be sawed and drilled . . . bolted or nailed. Corrulux is also available in flat panes, which end window breakage problems forever when glass panes are replaced with shatterproof Corrulux Flat Panes.

WHERE YOU CAN GET CORRULUX. Three weights of Corrulux are available: Functional, Structural and Heavy Structural. For more details, look in the Yellow Pages under *Plastics*, or write to Johns-Manville, Box 158, Dept. F-1261, New York 16, N. Y. In Canada, address Plastics and Allied Products, Ltd., Dundas, Ont.

JOHNS-MANVILLE JM PRODUCTS

General Electric Makes Eddy-current-coupling Drives

And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them KINATROL* drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

A General Electric KINATROL drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

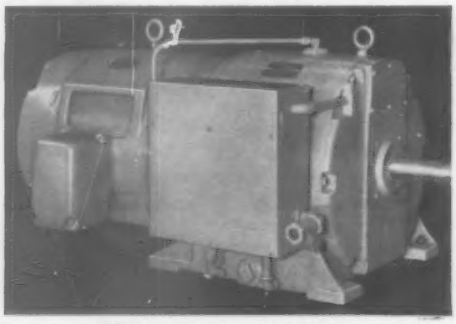
KINATROL couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

KINATROL —a good product, with the kind of service you can depend on. Please call your nearest General Electric Sales Office for further details.

*Trademark of General Electric Company

821-07

AIR COOLED, 7-1/2 to 100 HP



WATER COOLED, 25 to 150 HP

AIR COOLED, 1 to 5 HP

DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT

GENERAL ELECTRIC

ERIE, PENNSYLVANIA

For more facts Circle 459 on Reader Service Card

Begins on page 116

Coffee prods production

Make the coffee break work for you on the production line. Goodyear Aircraft Corporation, Akron, Ohio, does it with a message on every coffee cup sold at its vending machines. Old safety slogans (a standby on cups for many years) have given way to a new message—the value of productivity.

This high-saturation communications tool, developed by the company, is being adopted by the vending machine operators for use by other plants.

Report card on safety

Ask any foreman at Ford Motor Company's Frame Plant (River Rouge, Mich.) "what's the score?" and he'll whip out his safety score card. The approximately 6-in.-sq. card figures prominently in an intensified program to reduce accidents.

By following the checklist on the score card, plant foremen are reminded to safety-inspect all operations; conduct 5-minute safety talks with workers; brief new or reassigned workers on safety; use disciplinary action when needed; make job changes to improve safety; record dates of last "near miss" accident and last major injury; and make any safety recommendations considered necessary.

After completion, the card goes to the general foreman, then to the safety engineer.

Managers air job problems

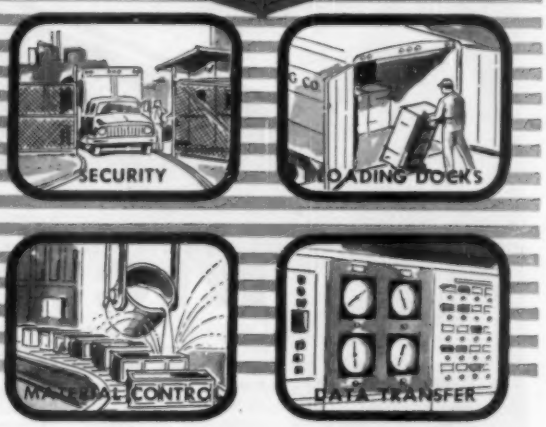
The right hand at International Minerals & Chemicals Corporation knows exactly what the left hand is doing. A course for managers at its Carlsbad (N. M.) plant is the successful communications tool.

Now under way, and attended by 104 supervisors, the course aims to improve job performance by discussing basic management principles and techniques. Supervisors are called on to discuss such topics as:

1. Advantages and disadvantages of supervisor's job; skills and attitudes needed for leadership.
2. Poor planning and how to overcome it.

Turn the page

PHILCO
CLOSED CIRCUIT TV
ELIMINATES INDUSTRIAL "BLIND SPOTS"



Philco closed circuit TV has proven invaluable in checking operations that are normally difficult and awkward to monitor in person . . . material flow on conveyors . . . bin levels . . . loading dock traffic . . . gate traffic . . . gauge watching. In addition, closed circuit TV can be used in employee instruction and plant communications. Philco's broad experience in CCTV guarantees putting this very flexible business tool in use to your best advantage. Fully transistorized equipment featuring Philco's "building-block" design assures ease of operation, freedom from maintenance problems and permits future expansion without costly replacement. Write today for your copy of the Philco Closed Circuit TV System Planning Guide.

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. . . and put an end to wasteful and costly converting problems!

The Stanford Slitter economically and efficiently converts paper, cellophane, acetate, plastic, foil laminates and other coated and uncoated materials with easy, one-man operation! The unit features Stanford Automatic Web Guide which holds side register to plus or minus .010 of an inch, automatic-controlled constant tension brake and convertibility from score or shear cut to razor blade slitting. Low overall height and ample spacing between feed rolls, slitting rolls and rewind shafts permit easier, faster threading and unloading.

STOP WASTE
SAVE TIME
SPEED PRODUCTION
STANFORD-IZE!

For further information on Stanford Slitters, write to Dept. SE92

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SALEM, ILLINOIS

For more facts Circle 461 on Reader Service Card

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Companies "prospecting for plant sites" . . . find rich new benefits in Colorado. Pleasant Living, a product of Colorado's magic climate attracts and holds the most competent personnel. Industry's westward migration has made Colorado the transportation hub serving the vast new markets west of the Mississippi. "Site-see" Colorado now . . . right at your desk.
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For more facts Circle 462 on Reader Service Card

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HUMAN RELATIONS

3. Personal problems with subordinates and fellow-workers and how to minimize them.
4. How to motivate people to better performance and higher morale.
5. Induction and training of new employees.
6. How to improve communication skills.
7. Do's and don't's of on-the-job training.

Prize for hidden pay exposé

Fuzzy's the word for employee knowledge of fringe benefit costs. So Royal McBee Corporation figured a monthly contest with cash prizes was just the thing to focus their attention on these staggering figures.

Tagged the "Hidden Pay Check" contest, entry blanks are actual check forms. Hourly workers in Athens (Ohio), Ogden (Utah), St. Louis (Mo.), and Toronto (Canada) plants are eligible.

Contestants submit monthly estimates (for 10 months) of what the average Royal McBee production worker receives annually for each of 10 benefits. The first guesstimate is on vacation pay. Others include rest periods, shift differentials, pensions, overtime, unemployment and group insurance. The 10 workers who come closest to actual figure each receive a $25 savings bond. All entries qualify for grand prize at contest finale—a $100 bond. Cost to company for this program is $350 in prizes.

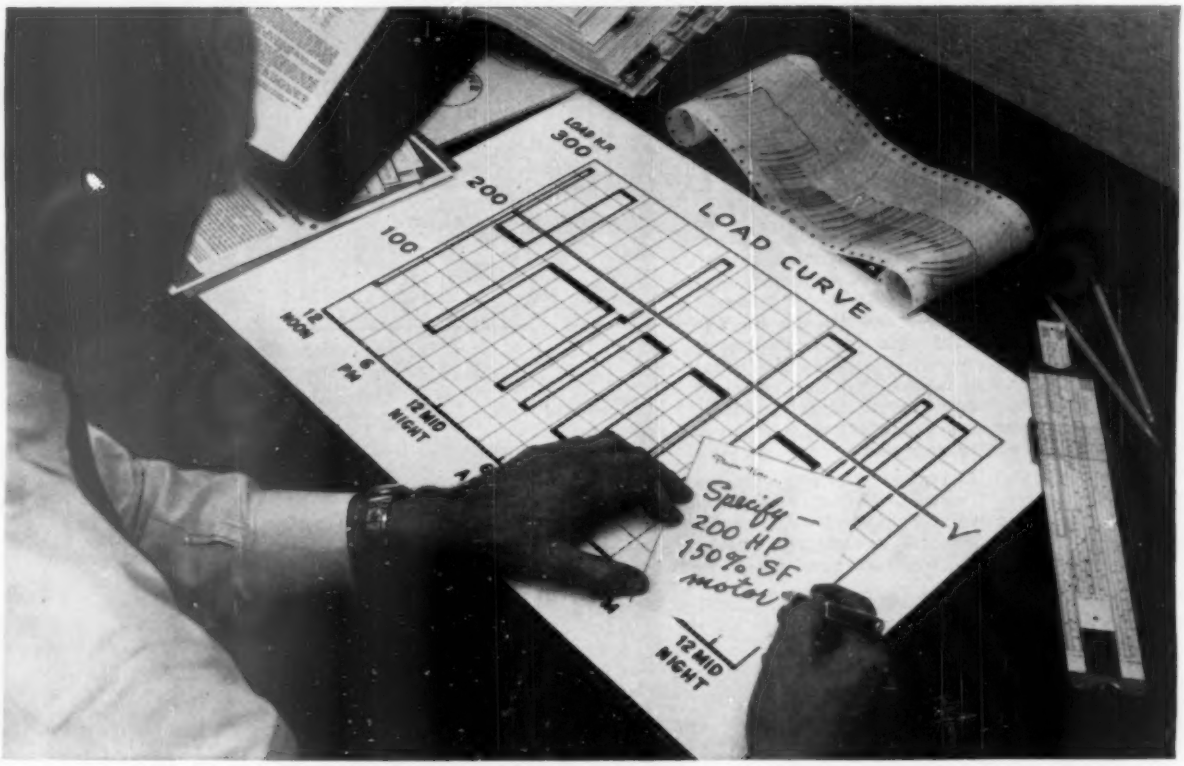
Looks like 85¢, costs 65¢

Thompson Ramo Wooldridge, Inc. (Cleveland), is cutting cafeteria operating costs and passing the savings on to its workers. Taking a cue from "you can't tell it from the 70¢ spread," it offers a package lunch on a tray for 65¢. The same lunch with personal service and chinaware costs 85¢.

What's the difference? Not quality or quantity. That's the same in both cases—soup or juice, sandwich, salad, dessert, and beverage. But the "high-low" (high quality, low price) lunch is prepared in advance using plastic plates. This package can be picked off the shelves fast by workers. There's only one hitch—you have to buy a complete lunch "as is."

SILICONE NEWS from Dow Corning

Over-motoring Out-moded



Specify horsepower for nominal loads, Service Factor to handle the peaks!

Specifying motors with nameplate horsepower rated for peak load conditions is rapidly being out-moded as too expensive.

Today, it's far more economical . . . and just as reliable . . . to specify silicone insulated extra service factor motors with horsepower ratings based on nominal load conditions.

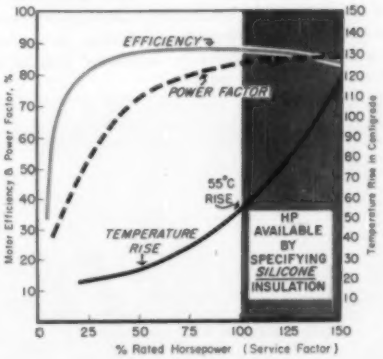
Additional horsepower output — up to 50% above nameplate rating — is available for peak loads.

Where does this additional capability come from? It's the hidden horsepower in the higher service factor rating! It's the result of the exceptional thermal stability of silicone insulating materials.

Life and reliability of these motors is unaffected by peak loads . . . silicones are immune to the heat of even constant loads within the service factor rating. So why specify a 300-hp motor when a 200-hp motor with a 150% service factor is what's needed? Silicone insulated extra service factor motors give you these extras, too:

Top efficiency is obtained under normal load since the motor is operating at its designed horsepower rating most of the time.

Additional savings in several ways: additional nameplate horsepower is usually more expensive than the extra service factor silicone insulation provides; additional horsepower requires extra floor space and heavier mountings; over-motoring power factor problems are eliminated or minimized.



Free brochure—"Specify Silicone Insulated Equipment and Save." Write Dept. 4424.

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MIDLAND, MICHIGAN

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For more facts Circle 463 on Reader Service Card

New GE 3101 DATA ACCUMULATION and COMMUNICATION system...

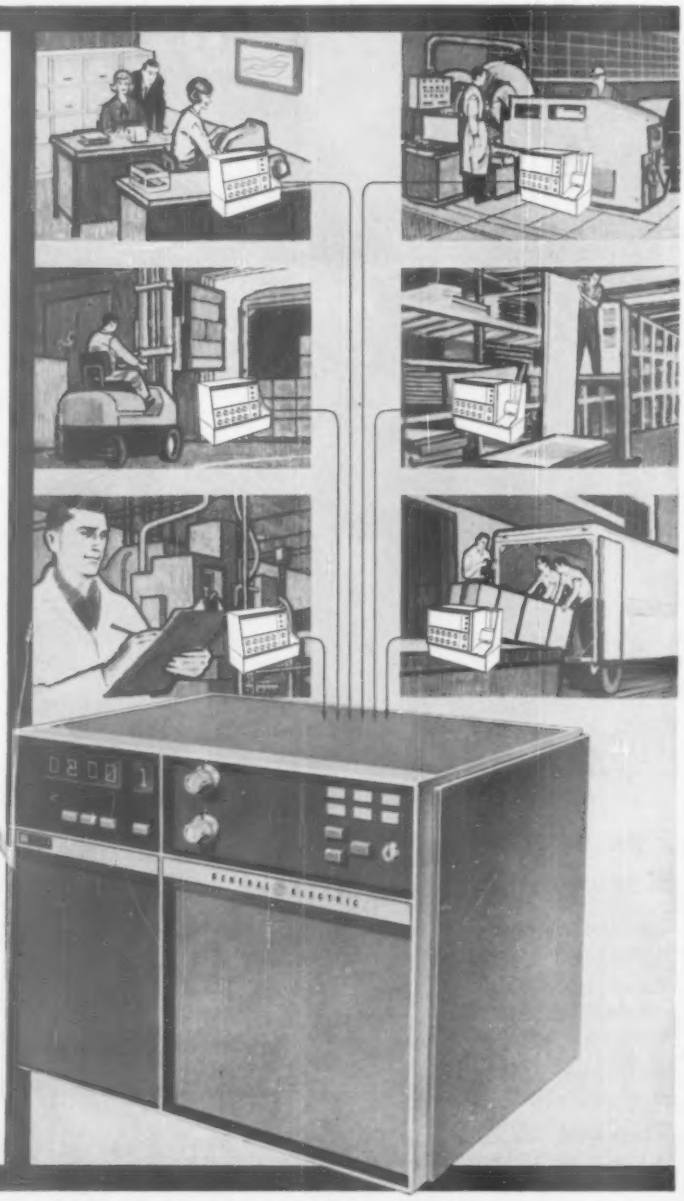
...provides immediate plant/ office data communication ...as a management tool to increase production and reduce costs.

The GE 3101 is General Electric's answer to the need for an economical and effective means of collecting operational data. Key areas such as purchasing, receiving, quality control, shop operations, warehouse, shipping, etc., send current data to a central point for collection and display. Each of the key areas has a Collector that sends data to the Accumulator, where it is punched into paper tape for a permanent record. Data originating at the Collector is from punched cards and/or 19 variable dial settings. Collectors may be up to 10,000 feet from the Accumulator.

The punched paper tape can produce a typewritten copy immediately for visual display of current conditions; can be converted to punched cards; or can be used for direct input to a computer system. Investigate this new, lower cost development by General Electric.

Installation of the GE 3101 information gathering system can result in greater operational profits due to: accuracy and timeliness of data, economy of operation, and quicker access to the facts for well informed decisions by management.

For more information, write for brochure CPB-183, General Electric Company, Computer Department, Section 92V12, Phoenix, Arizona, or contact your nearest General Electric Computer Department District Office listed below.



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CPA 92 (9-61)

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FACTORY'S CASE BOOK OF

ENGINEERED PLANT SAVINGS

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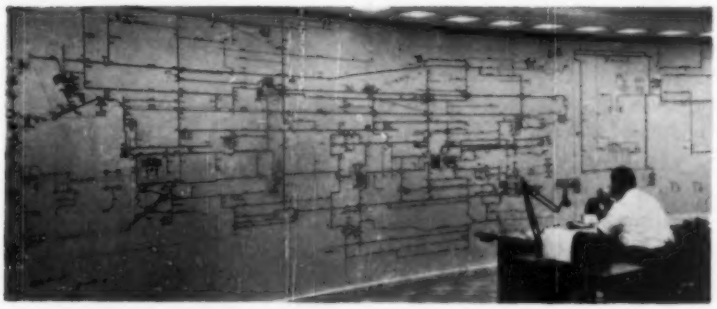

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FACTORY'S CASE BOOK OF

ENGINEERED PLANT SAVINGS

NORMAN H. SOLON, EDITOR

No. 48 December 1961

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BREAD PANS and fruit jars on the pegboard keep contents visible, are space-savers for small hardware.

PEGBOARDS have false fronts that swing out to allow back-up storage of items without cluttering aisles.

WIRE CARTS—standard equipment in supermarkets—are used by those needing a variety of hardware.

CHECKOUT COUNTER with a roller conveyor is used. Housewives would balk, though—no stamps.

Warehouse apes supermarket

This General Dynamics Corporation warehouse at San Diego, Calif., would do credit to an efficient A&P supermarket. Their problems are alike.

However, instead of a hoard of bargain-hunting housewives, the warehouse services some 750 technical personnel who need a myriad of hardware for research problems. And they need it on the double.

El transports cargo

This overhead monorail makes short work of transporting materials between twisting and finishing departments of China Grove Cotton Mills, China Grove, N. C. And it saves $7000 a year in handling costs.

Before, men had to push and lug trucks up ramps, on elevators, and over long walks between the two buildings. Inclement weather often hampered the operation, and accidents caused by manual handling were always a threat.

Now trucks of yarn are rolled into the freight van. At the touch of a button the van moves on its way without an attendant. And it stops and lowers automatically at each end of the system.

The system is manufactured by Cleveland Crane & Engineering Company, Wickliffe, Ohio.

Washing machine for lighting fixtures

About one third of the time normally required to clean louvers has been lopped off by using this portable lighting fixture washing machine at Ohio Savings Association, Cleveland. This idea can be adapted by any plant.

The 130 louvers in the building are removed, cleaned, and re-installed in only 24 man-hours. With conventional tanks it would take 30 to 36 man-hours. The washing operation itself takes only 8 minutes.

The self-contained unit automatically applies wetting agent, detergent, brushing, rinse spray, and destaticizer to luminous ceiling panels and fluorescent fixture diffusers. And it provides higher foot-candle readings than tank washing does. Soiled fixtures are just inserted into the machine from one side and removed clean and ready for stacking from the other side.

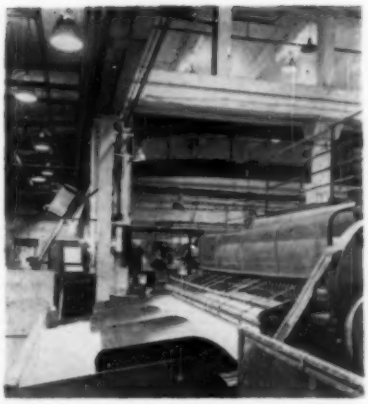
The machine is made by Wash-A-Matic Company, San Francisco.

Strictly straight

If a rifle barrel deviates from a straight line by as little as one-tenth the thickness of a human hair, it will be spotted by this optical device at Springfield Armory, Springfield, Mass.

The system (Barnes Engineering Company, Stamford, Conn.) is accurate to 0.0003 inch. It consists of a light source, an arrangement of lenses, a beam splitter, and a variety of prisms designed to reflect the test beam from a probe pulled through the barrel. This beam impinges on a lead-sulfide detector, which, by the change in signal strength received, causes rotation of a servo-driven restoring plate.

The amount of rotation is the final output that's directly converted into a numerical error signal.



Mercury lamps outdo daylight by 550%

Installation of a mercury-vapor lighting system has raised the light level of the cutter end of this machine to 110 ft.-c. at Continental Paper Company, Ridgefield Park, N. J. Previously, the machine was illuminated by an overhead skylight providing only 20 ft.-c. This resulted in poor-quality production.

The open-bottom lighting units shown in the photo are designed for ceilings up to 30 feet high. The 400-watt fixtures are spaced on 16-ft. centers. The reflectors are made of prismatic glass and are housed in protective metal covers. They have top-to-bottom optically precise prismatic corrugations molded on the outer surfaces. This design directs the light downward within a 120-deg. cone.

Workers get no glare in their eyes. This is due to the prismatic control, plus the fact that the reflector extends well below the bottom of the lamp.

The reflector is open at the top to illuminate the ceiling. This also creates a chimney effect that carries dust through the unit, and reduces dust collection on its glass surface to a minimum.

Contributions from readers reporting experiences will be welcomed. No need for fancy writing; just a clear, concise statement of facts. If you have photos or drawings, be sure to include. We'll edit for the Case Book. Contributions accepted will be paid for at time of publication. Address: Case Book Editor, FACTORY, 330 West 42nd St., New York 36.

PUNCH IN KENTUCKY FEEDS DATA TO WISCONSIN

PUSHBUTTON MAKES CARDS IN TWO STATES

Electronic machines talk payroll

Electronic telephone conversations between data processing machines in Wisconsin and Kentucky are cutting down expenses while speeding up the job of preparing payrolls for three Modine Manufacturing Company plants.

The payroll for the three plants (Racine, Wis., and Paducah and LaPorte, Ky.) is made up at Racine based on information fed electronically via leased telephone wires. Here's how it works:

In Paducah, the key is an IBM 357 system (International Business Machines Corporation, Poughkeepsie, N.Y.) shown in the top photo. There are eight of these machines throughout the plant. Workers punch in on two cards. One when they enter and leave the plant and a second when they complete an operation. Immediately they punch into the system, the information is transmitted to two output stations in the plant. From there it goes to Racine over a leased wire by means of an IBM Transceiver. When the phone line is not transmitting data it can be used for voice conversations.

The system varies slightly at LaPorte. Instead of input and output stations, the plant has a key punch machine (bottom photo) which is used to keypunch the handwritten payroll data. A verifying machine checks the accuracy of the keypunching. Once the cards have been punched, the data are transmitted over a Transceiver to Racine in the same way that information is sent from Paducah. On the Racine end, another Transceiver "listens electronically" to the signals from Kentucky and duplicates the information on blank IBM cards.

Advantages of the new system:

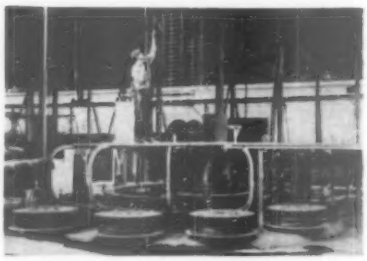
- It needs less equipment than other systems, thus minimizes problem of finding qualified personnel.
- It's speedy. Checks are made out in Racine for the two Kentucky plants and delivered the day after receipt of final data.
- Paducah's collection system also allows the company to check on work in process and to maintain reasonable levels of inventory.
- It eliminates much of the foremen's paperwork.
- It improves accuracy of job reporting—there's no interim in which the worker forgets details.

In step with output

Production is not a slave to fixed-speed conveyor lines at Evinrude Motors, Milwaukee. The touch of a switch slows down or speeds up the plant's three conveyors as needed—independently of each other or in any desired ratio.

An a-c drive system (U. S. Electrical Motors, Inc., Los Angeles) controls the conveyors. The Varidyne power unit provides power of adjustable frequency. Motor speeds vary directly with frequency. Speed changes are smooth and stepless.

If the system should happen to go on the blink, fixed-speed conveyor operation can be obtained by bypassing the power unit and connecting the motor circuit directly to the plant's 60-cycle supply.



Wire winder whirls

Cost of producing cages of reinforcing steel used in concrete pipe has been cut from 25 to 40% by this wire winder at Associated Sand & Gravel Company, Everett, Wash.

The job used to be done by hand, with wire wastage of up to 15%.

But the new plant-made machine virtually eliminates waste. It consists of a turntable rotating at 12 rpm. and a 2-hp. electric motor. It wraps wire at 1½- to 4-in. pitch in a continuous spiral. Wire for the vertical reinforcing comes from reels adjacent to the turntable, through a series of hitch plates. The wire is welded to the spiral by spot welders on the plates. The welders are actuated by air cylinders, with a 100-kva. transformer supplying welding potential.

The machine has controls to form the closing wrap and a device to discontinue welding automatically or to obtain loose wire for forming a bell at the mouth of the cage. It can form 1000 feet of cage, for 12- to 72-in.-dia. pipe, in an 8-hcur shift.

The vertical cage is lifted from the machine by a ½-ton hoist and rolled down an incline to a welder. He forms the bell wires and spot-welds the spacing chairs.

SAFETY—OR A PUNCH IN THE NOSE

If workers don't want to turn friends into enemies, they have to be safety-conscious at Thiokol Chemical Corporation, Marshall, Tex. This safety board tells why. One badge number is drawn weekly and posted on the board at the plant entrance. Four weeks later the employee with that number receives a $100 savings bond if he has had perfect attendance during the period, and if his safety group has no injuries. An unexcused absence cuts the award to $50 and an injury in his work group cuts it to $25. Anything worse means he gets nothing. The climate can get awfully chilly for the worker who ruins the award for another.

Rayon strapping packs pipe pronto

Strapping tail pipe is being done 20% faster at Emsco Screen Pipe Company, Houston, Tex. A change-over from reinforced filament tape to rayon strap has speeded up the job, and also made it safer.

Metal tape could not be used because it was scratchy, and sticky tape slowed down the operation. Also, slipping had become a continual hazard in transit. The non-sticky rayon strapping (American Viscose Corporation, Philadelphia) grips tightly and can be handled easily with no danger from jagged edges. Packages tied with Avistrap can be opened quickly with a penknife or office scissors.

EDP turns architect

A cold calculating machine was the chief architect for International Business Machines Corporation's new warehouse in Poughkeepsie, N. Y. Afterwards, the RAMAC computer turned right around and delivered a critique on its own work.

The computer was used to figure the optimum size of the building, spacing of the racks, and other engineering decisions. Typical days of warehouse operation were simulated on the computer to make sure that RAMAC's thinking was straight. Potential bottlenecks, the number of tow trucks required, the effects of peak loads, and the probability of recirculation were all programed into the machine.

Computer input was varied to simulate three operating conditions: peak, normal, and slack. The output of the computer permitted planning engineers to anticipate in advance the necessary scheduling changes and manpower switches for each of the three conditions.

Three hours of computer time simulated 12 hours of actual operations. Result: RAMAC the critic passed RAMAC the architect.

Stationary? Nossir.

What do you do when a two-story 460,000-lb. office annex is no longer needed in a certain area? Minute Maid Company, Orlando, Fla., had it dug up and moved.

Saunders Construction Company, Winter Park, Fla., moved the structure 400 feet to its new location. This required some rather tricky maneuvering, including a 90-deg. turn through the plant's main gate.

Management development on a shoestring

They're building tomorrow's management team today at Narda Microwave Corporation, Plainview, N.Y. What's more, they're building greater cooperation and understanding into today's supervisory group—and all of this without a budget.

Following the lead of the big corporations, the tiny Narda company (200 employees) recognized the need to backstop today's management with an alert, informed group. And being in the fiercely competitive electronics industry, Narda knew it would be crushingly expensive to go out and hire a new manager each time the need for one cropped up.

Scanning his company's future manpower needs, Narda's young president, William Bourke, started a program to build self-sufficiency into the management ranks. He embarked on the project with less money than most management development programs allot for scratchpads. Meetings have been held in his own office right from the start. Bourke conducted the first meetings himself (top photo), but currently handles them a little less frequently. Day-to-day supervision of the program is now handled by Narda's personnel manager, David Austin (lower photo).

Participants in the program come from first-line management throughout the plant—quality control, production, engineering. There are two groups of 10 each. Each meets for two hours every other week.

There have been sessions on motivation, new employee evaluation, supervisory techniques, production planning. The sales manager comes in to explain the problems faced by the company's customers. The trainees themselves explain their own operating problems, and share common experiences. Methods improvement gets a big share of the trainees' attention.

Laced through the course is a healthy dose of company policy—everything from design philosophy to financial status. All this gives the trainee a sense of participation; he's on the "inside," and can get straight answers to his questions, is assured his comments will be taken seriously. In short, he's getting a first taste of being a manager.

Is the program *really* developing managers? Narda feels certain that it is. Men who have been through the program have already picked up good managerial habits. They communicate better. They recognize each other's problems. They are taking advantage of a tuition refund plan to build managerial skills on the outside. They attack problems with a plant-wide perspective rather than a narrow, one-department view.

Probably the key to this acceptance is Narda's obvious sincerity. It is a growing company that needs young blood in the managerial ranks. "There are positions we want to fill with these men, and they know about them; that's undoubtedly the reason for their enthusiastic response," says David Austin. And the fact that the company president has been active in the program right from the start proves that this is a top-priority project, not a "busy-work" scheme.

Is smallness a handicap? No. Narda feels that, on the contrary, small companies have a number of advantages over the giants when it comes to building managers from the inside. These advantages include small groups, informality, easier explanation of plant-wide (or company-wide) problems, and more opportunity for top management to participate.

Red light warns of collision

Fork trucks traverse this ramp some 600 times a day at West Virginia Pulp and Paper Company, Covington, Va. Yet there's no possibility of an accident.

Since the ramp has a blind corner in both directions, traffic lights have been set up to prevent collisions. When a truck approaches the ramp the driver checks the light at the turn. If it's red, it means a truck is approaching from the opposite direction. When it turns green, he proceeds. Upon entering the ramp, he pulls a conveniently placed cord which changes the lights to red at both ends of the ramp. On leaving the ramp at the other end, he pulls a second cord that re-sets the lights to green.

Paint booth on rails

Here's a real man-bites-dog story. This paint booth on rails sprays a stationary railroad car at Pullman-Standard Inc., Butler, Pa.

The giant painter unit moves over the top of the cars at a speed of 130 to 170 inches per minute, painting top and sides simultaneously. It's equipped with pairs of automatic airless guns working on adjustable reciprocating arms. One pair of guns paints the top while other pairs work on the sides. Inside the unit two painters with hand guns reach the hard-to-get-at places on top and sides of the car.

Altogether, the moving paint booth has two pumps, eight paint heaters, six automatic guns, and two hand guns (all marketed by Nordson Corporation, Amherst, Ohio).

The unit was developed by DeVilbiss Company, Toledo.

Adhesive calms restless rail joints

An adhesive is restricting the movement of conventionally bolted crane rail joints at Bethlehem Steel Company, Bethlehem, Pa.

Under normal conditions, there is loss of bolt tension, primarily through wear and seating at the adjoining rail and bar surfaces, plus the forces of expansion and contraction. Result is the rail ends move under traffic, with additional battering and spalling of the running surface. This, in turn, leads to high maintenance costs and cuts down on crane rail life. The only way the company had been able to counter this action in the past was through expensive welding.

With the new system, Bondarc adhesive (Armstrong Cork Company, Lancaster, Pa.) is applied to the mating surfaces between the joint bars and rails before they are bolted together. After the adhesive has cured, it forms a rail-joint bar bond. This aids in reducing the longitudinal separation that can occur between the rail ends.

Bondarc is a thermosetting adhesive that is mixed on the spot. It forms a bond through molecular linking between the adhesive and the material being bonded.

Reprints of the Plant Operations Case Book are available. Price 50¢. For quantity prices, write Reader Service Department, FACTORY, 330 W. 42nd St., New York 36.

Numbers game pins down production

The "guesstimate" has largely been taken out of production scheduling at Revco, Inc., Minneapolis. Reason: a point system that works.

The system started with the assignment of one index point to each half-hour of work. When figuring out schedules, various product components were assigned index points, varying with the number of hours required for assembly. These values are reviewed periodically.

When used for production planning, only 75% of the total index points are figured. This gives a 25% leeway for rejects, reworking, downtime, and other variables.

Basically, the system gives these three benefits:

1. It provides a common denominator for all types of production.
2. It provides reliable data for customers on shipment schedules.
3. It backs up promise dates.

Scrap isn't junk with this regrinder

Leftover scrap becomes raw material automatically with this plastic regrinder at Minneapolis-Honeywell Corporation, Minneapolis.

The regrinder takes plastic scrap from the mold machine, chews it up, then blows it back through the long tube (at right of photo) into the hopper on top of the mold machine. There the reground plastic is mixed with the virgin material.

The unit is portable, can be moved from machine to machine.

YOU BE THE ARBITRATOR

THE CASE OF

The jettisoned juryman

Out of the experience of the American Arbitration Association

When Dick B., a crane operator in a steel mill, was called to jury duty, he got a two-week leave, confident that all his rights would be protected under the "jury duty" clause of the union agreement. However, he was excused by the judge on Thursday of the second week, so was able to come back to work a day early—on Friday.

Dick didn't find out until later that on Thursday an overtime notice for Saturday had been posted on the bulletin board, and men who wanted to work signed up. The result was Dick wasn't asked to work on Saturday, and the records showed him as passing up a chance to work overtime. This deprived him of preferential treatment for the next overtime.

A grievance was then filed. "You could have notified me about the overtime," Dick said. "I would have been glad to work. Now you owe me back pay for Saturday, and also first crack at the next overtime assignment."

Management answered that it had followed established procedure. "We posted the overtime and assigned the work to men who signed up in accordance with their positions on the overtime roster. That's all we had to do. We never notify absent employees about overtime no matter what the reason for the absence. Furthermore, how were we to know your jury assignment would end early?"

Eventually, the case went to arbitration. Suppose you were the arbitrator. How would you rule?

For the actual decision turn to page 134

Exploring the think in plant management

Too often plant management games are based on policy decisions made at the top level—with pat formulas to solve all problems. Most of these games disregard the daily non-recurring problems whose solutions require judgment, not rules.

As part of a summer technical training program for qualified college students, Procter & Gamble Company conducted a judgment game at 13 of its plants across the country. In the exercise, 90 college students acted as plant managers for 15 one-hour periods—with each hour covering a month of operations. Each trainee was put in charge of an imaginary plant, which produced and shipped food products.

The game (MATRIX) uses a large number of non-recurring, judgmental problems that interact with one another. A decision made at the start of the game returns to "haunt" the player at a later phase.

All problems originate in the form of memoranda from various members of the participant's staff and from the division manager to whom he reports. At the end of the 15 months, the player is scored on his effectiveness in the areas of cost, quality control, and employee relations. Here are a couple of typical problems the trainees faced:

1. A shipment of essential raw materials is delayed. The player must decide whether or not to change the production schedule and manufacture another product.

2. Missing shipment of raw materials turns up. Just as production is getting back to normal, a partial failure in the dust and odor control hobbles the plant's production rate. Should the dust control unit be shut off? This might step up production, but could also cause complaints from the community.

The management game is the latest development in the summer training program started by Procter & Gamble in 1939. It provides summer jobs for students within a year of receiving their bachelor's or master's degrees in science or engineering. It provides them with an opportunity to study a career before embarking on it.

It has also been an excellent recruiting tool for the company.

Bang replaces punch

An underwater explosive part-forming system blasts parts into shape at General Dynamics Corporation, San Diego, Calif. It also blasts 40% off tooling costs, since it eliminates a

punch press—needed in most fabrication operations.

The part in the bottom photo is the metal before forming. It's placed in a die and submerged in a tank of water. Then a small charge of dynamite is set just below the surface of the water and slightly above the die. The resulting shock-wave forces the metal into the die, shaping it in a split second.

Wheels baby floors

King-sized floor repair bills are nonexistent at Sweetheart Cup Corporation's Los Angeles plant. Reason: urethane wheels on the company's industrial trucks.

The plant estimates it has saved some $3000 in floor repairs since the wheels (Disogrin Industries, Mount Vernon, N.Y.) were installed more than three years ago. Actually, the same savings could have been realized with rubber rather than metal wheels. But the rubber wheels lasted only two years when tested. No need for replacements for their urethane counterparts has been sighted even after three years.

Take-home CD

Civil defense goes beyond the plant at Lear, Inc., Grand Rapids, Mich. It reaches right into the homes of the 4500 plant employees.

Family survival kits have been distributed to each worker with instructions on fall-out shelters, fire-fighting CONELRAD, and emergency procedures.

Included in the brilliant red-and-white packets is a letter from the general manager of the plant, urging each family to read the booklets and to follow instructions.

CRANE DUBS AS WAY-OUT FIRE ENGINE

It takes just two to three minutes to convert this 7-ton mobile hydraulic crane into a real way-out fire engine. It's used at the Chalk River, Ont., plant of Atomic Energy of Canada Ltd. In an emergency, a large-capacity deluge set can be bolted to a plant-made permanent steel mounting plate on the telescoping boom of the crane. So rigged, the crane becomes a mobile water tower. The nozzle on the boomtip can be positioned quickly to throw heavy streams of water into upper stories of the building. Heights and angles of the nozzles can be adjusted by rotating, elevating, or telescoping the boom. The "cherry picker" crane shown here is made by Austin-Western Division (Aurora, Ill.) of Baldwin-Lima-Hamilton Corporation.

CASEBOOK CAPSULES

Butt-fusion technique for easy in-the-field joining of high-density polyethylene pipe has been developed by Phillips Chemical Co., Bartlesville, Okla.

World's lowest-price closed-circuit television system ($350 for home market) is being produced by Nottingham Electronic Valve Co., Ltd., East Bridgeford, England.

Electrodialysis process to convert brackish water into fresh at about 54 cents per thousand gallons is being marketed by Cleaver-Brooks Co., Waukesha, Wis.

Got H-bomb jitters? A self-contained anti-nuclear fallout utility system, composed of an automatically controlled electric power plant, multiple radioactive fallout air separators, air-conditioning and forced-air systems, is being produced by Frigikar Corp., Dallas. System functions entirely on butane which doesn't deteriorate.

Mechanical road pavers can lay highways with surfaces as smooth as bowling alleys with a new control system and sensing device announced by Minneapolis-Honeywell Regulator Co., Minneapolis.

The children's union may object to a new snow-melting device (Esso Research and Engineering Co., New York). It can dispose of 50 tons of ice—a mess 5 feet high, 10 feet wide, 40 feet long. It could make sleigh rides passé on New York streets this winter.

Thirsty? Americans use 320-billion gallons of water per day, according to American Machine & Foundry Co., New York. This is over 60% of the supply available. By 1980 demand will exceed supply by 80-billion gallons per day if present practices continue.

Particle analysis technique, developed by California Institute of Technology, Pasadena, will be used to measure the extent to which visibility-reducing particles are formed in various smog reactions.

Big eye speeds truck loading and dispatching

Television teams up with readout equipment to speed dispatching at Dundee Cement Company, Dundee, Mich. Here's how:

Truck scales at the packing house have the usual dials for loading. But they also print the weights remotely at the sales office 500 feet away. There a dispatch clerk types up the bill of lading (left photo) while trucks are being loaded. When the driver is ready to take off, the bill is delivered to him via pneumatic tube. He signs a copy and immediately puts it back in the tube.

Each truck is identified by a code signal system. But to insure against error, there's a TV camera at each loading point and a monitor at the clerk's desk. The control panel signals the clerk when a truck is waiting.

Closed-circuit TV is also used at the plant to facilitate production. Eight cameras and ten receivers monitor strategic operations. For example, the secondary limestone crusher operator can remain at his controls and view these four locations at once (right photo):

- Inlet to raw limestone crusher at quarry.
- Outlet of crusher.
- Reclaim tunnel under stockpile.
- Discharge belt into silos at the main plant.

Paper carries roller, oh so gently

There's no need to ship large stainless steel rollers in heavy wooden boxes at Greenville Steel and Foundry Company, Greenville, S. C. Corrugated cartons do the job safely and less expensively.

Wooden boxes were formerly used to protect the mirror finish of the 68-in.-long, 23-in.-dia. rollers. They took two men half a day to construct and package.

Now, corrugated cartons delivered flat can be assembled, loaded, and readied for shipment by two men in less than 30 minutes.

The paper box is protected by a full overlap top, a stitched joint, and two 450-lb. double-wall liners. Four wooden 2x4-in. boards, cut to width, are fitted over and under the roller for additional safeguard in transit. When roller size varies, corrugated sheets can fill air space. And two cartons can be telescoped to package large items.

Result: Savings as much as 50% on each shipment.

Belting out burrs

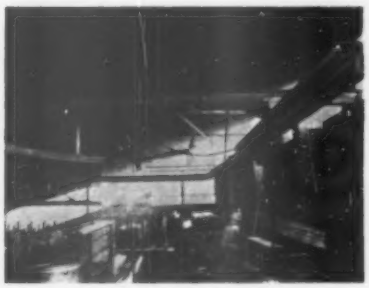
This narrow belt sander quickly removes burrs from hard-to-reach spots on aluminum die-cast housings.

The 1¼-in.-wide belts run at 100 feet per minute at Portable Electric Tools, Inc., Chicago. The set-up

consists of two belt pulleys, one on the motor and the other on a separate pedestal. Long and flexible, the belts can reach spots that might be difficult even by hand sanding. And they can do the job more than three times as fast.

Cost: Just $187 for both parts and labor.

Hint: If you adopt this idea, it might pay to attach a guard to the belt and thus eliminate a hazard.



Real swinging boom makes loading easy

The muscle-straining manual job of loading ½-ton bundles of steel channels into trucks has been eliminated at Versabar Corporation's Jersey City, N.J., warehouse. The company now uses a monorail system with a swinging boom that reaches right into the truck. This does the job fast with only one or two men.

It used to take three men to load a bundle when the warehouse was equipped with an overhead bridge crane. The bundle was placed halfway into the truck, and in this position the trio were able to push it all the way in by slipping the sling back and advancing the crane. This was a hazardous method, especially when the bundles had to be stacked two or three deep.

Now one man can pick up a bundle and deposit it right inside the trailer without manual handling. Here's how it's done:

The equipment consists of an L-shaped monorail, with one leg fixed and the other leg free to swing in a horizontal plane. The swing section is supported at a point about 14 feet from the end by a trolley that runs on a curved rail (top photo). This permits the leg to swing in a 150-deg. arc.

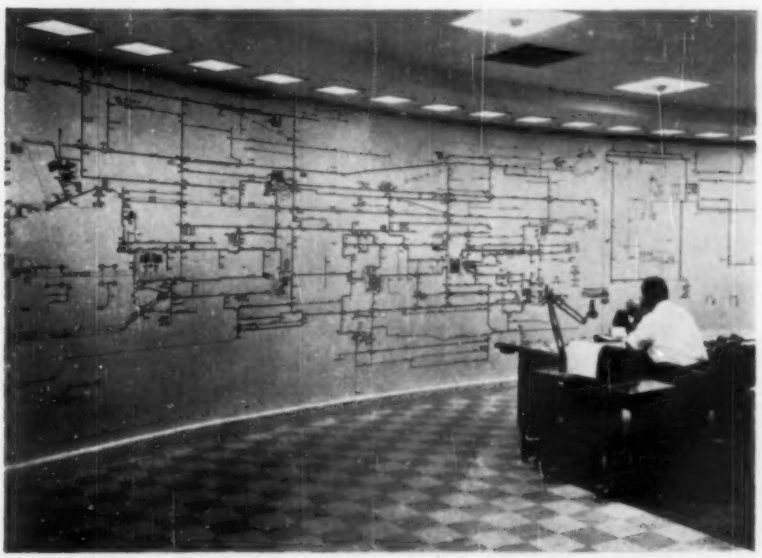
When a truck backs into the loading dock, the 14-ft. boom projection swings right into the body of the truck (bottom photo). The bundle is thus deposited inside the van without any further handling. And the lateral swing of the projection makes it easy to spot the bundle at any point for shipment.

The system is made by M-H Standard Corporation, Jersey City.

10 ways to save

Modernization needn't be a budget-wrecking proposition. Wendell Anderson, director of facility planning, AMP Inc., Harrisburg, Pa., offers as proof these 10 low-cost modernization steps that are both simple and effective:

1. If modernizing your present plant is economically unfeasible, look for and purchase a building that can be adapted to your needs.
2. Take advantage of the host of cover-up materials on the market. For example: concrete block glaze, epoxy paints, plywood panels, asphalt floor tile.
3. Check ways of reducing the noise level of your plant.
4. Review your power distribution system with an eye to greater simplification and flexibility.
5. Color-code your piping for easy maintenance, plus safety.
6. Accommodate your auxiliary heating needs with resistance heating equipment.
7. Landscape your grounds or take similar action to present a favorable face to the public.
8. Revamp your plant lighting system and reinforce the job with proper painting.
9. Install a music-over-a-speaker system.
10. Take any steps necessary to ventilate the plant properly.



MAMMOTH WALL MAP POINTS TO TROUBLE SPOTS

This giant wall map outlines the entire distribution system of Florida Power Corporation, St. Petersburg. The principle can be adapted by any plant. The 8½x36-ft. map shows the location of 400 miles of overhead distribution feeders and 50 miles of underground cables. Drawn to scale with pressure-sensitive tape, the feeders and cables are color-coded (Chart-Pak, Inc., Leeds, Mass.). Also, packaged symbols represent oil-circuit breakers, regulators, air-break gang-operated switches, and other equipment. When trouble is reported, the dispatcher can easily determine on the map which areas are affected.

Bubble test booth ignores temperature

A plastic bubble dubs as a portable test area anywhere at R. K. LeBlond Machine Tool Company, Cincinnati. It's used to run off and test tape-controlled lathes.

The bubble, held up by air pressure, is air-conditioned and can maintain temperature within 5 degrees of setting when shop temperature varies as much as 25 degrees.

The structure is 12x25 feet with 9 feet of headroom. It has an air-lock entrance and is attached to the floor by simple pipe cleats. This makes it easy to move from one lathe to another as needed.

Cutting in jig time

Cutting tapered table legs is no problem with this jig at Marshall Studios, Veedersburg, Ind.

The plant-made jig consists of the head and tailcock of an old jeweler's lathe mounted on a board. The wheel at the right end is indexed for either four or six tapers and a spring-tensioned blade bears against it. This prevents the work piece from rotating.

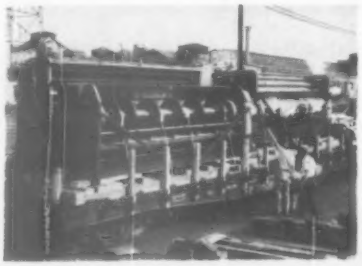
A fence on the band-saw table provides the correct taper, and the loaded jig is simply pushed through the saw (Rockwell Manufacturing Company, Pittsburgh).

Specifics on safety

Safety rules and posters in most plants deal with generalities that too often go right over a worker's head. At best, they only make him safety-conscious for the moment. But at Maytag Company, Newton, Iowa, they get down to specifics.

Management has prepared safety rules pamphlets for each department in the manufacturing division, as well as a general safety rules booklet. Employees get both publications. When transferred, an employee receives a copy of the safety rules covering his new assignment.

Individual booklets for 20 departments have already been issued and one is now being prepared for office personnel.



Traveling doesn't have to be shocking

Heavy machinery is shipped cross-country without dismantling by Samuel M. Langston Company, Camden, N. J. Yet there's no danger of damage from shock with this specially designed freight car.

In this car an 86x190-in. printer slotter, weighing 124,400 pounds was shipped from Philadelphia to Colton, Calif., in regular freight service. Use of standard freight cars would have meant dismantling the machine and shipping it in three or four cars.

The new car (Thrall Car Manufacturing Company, Chicago Heights, Ill.) contains an underframe which hydraulically absorbs the shocks of starts and the impact of coupling additional cars to a train. It is 60 feet long, about 10 feet longer than conventional freight cars.

Its roller-bearing construction enabled six men to push the loaded car, weighing nearly 100 tons, out of the way on the plant siding.

YOU BE THE ARBITRATOR

Continued from page 130

The award—After reading the contract and going into past practice at the plant, the arbitrator found the company was right in that it had no obligation to get in touch with absent employees and offer them an opportunity to work overtime. So Dick didn't get paid for the Saturday. But the arbitrator declared the company had no right to credit Dick with an "overtime opportunity" and thereby deprive him of preferential treatment next time around. He ordered the records changed to put Dick at top of the list for the next overtime opportunity.

Caution: The award in this case is not an indication of how other arbitrators might rule in other apparently similar cases. Arbitrators do not follow precedents. Each case is decided on the basis of the particular history, contract, testimony, and other facts involved.

Scoreboard rates quality control

Quality control is no secret at Union Carbide Metals Company, Marietta, Ohio. This customer satisfaction scoreboard is placed right at the entrance to the plant building. Nobody can miss it.

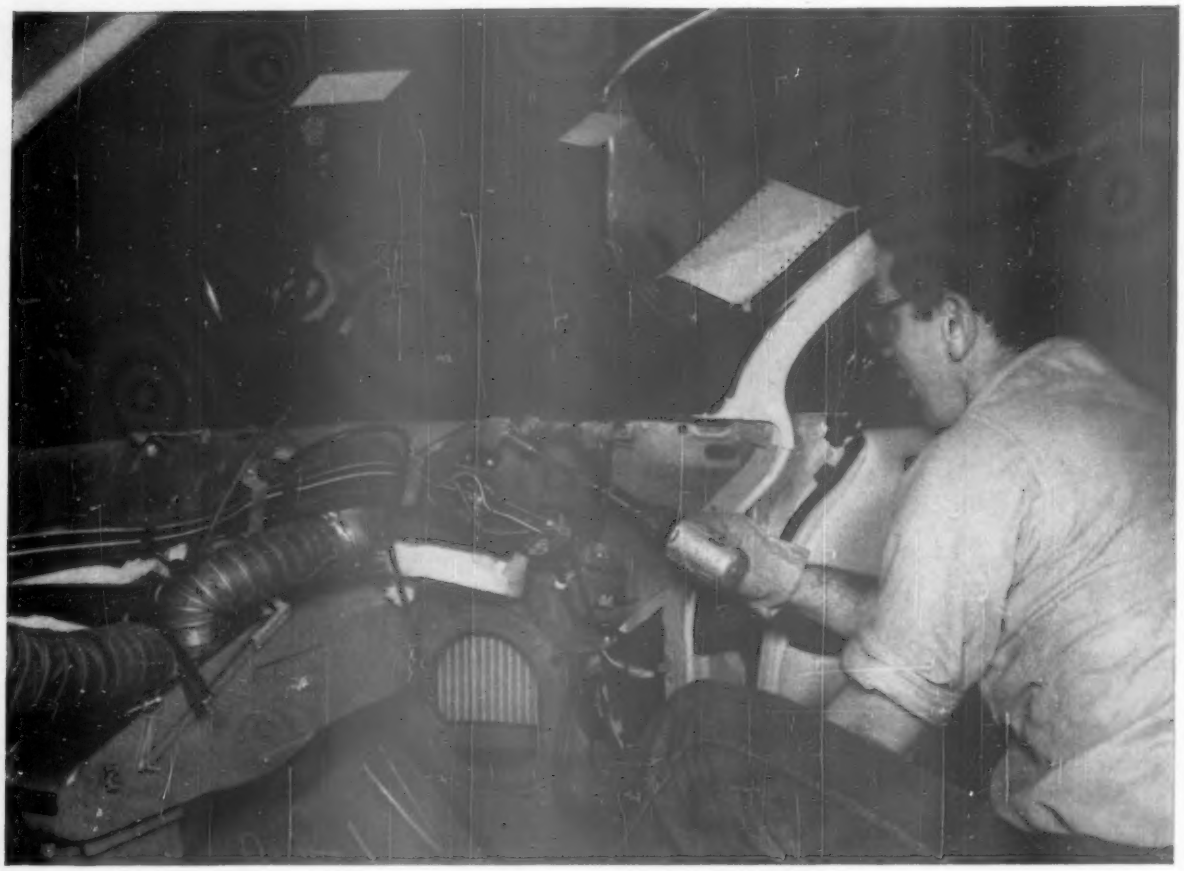
The board tells the number of complaints per 1000 shipments for the previous year and how many of these complaints are justified. It also compares the current year to a preset standard.

If complaints rise above the standard, it's a red-light signal to the employees to get on the ball.

BEAT DOWN COSTS...

FOR UP TO 4% MORE NET PROFIT

The Texaco man has a weapon widely used by management caught in a profit squeeze. It's Texaco's "Stop Loss" Program—a new concept of cost control through organized lubrication. Right now, this plan is helping manufacturers everywhere to save. Find out how it can help you cut your maintenance costs by as much as 15%—add as much as 4% to net profits. Write for our informative folder: "How to Starve a Scrap Pile." **TEXACO** INC., 135 East 42nd Street, New York 17, N. Y. Dept. F-210

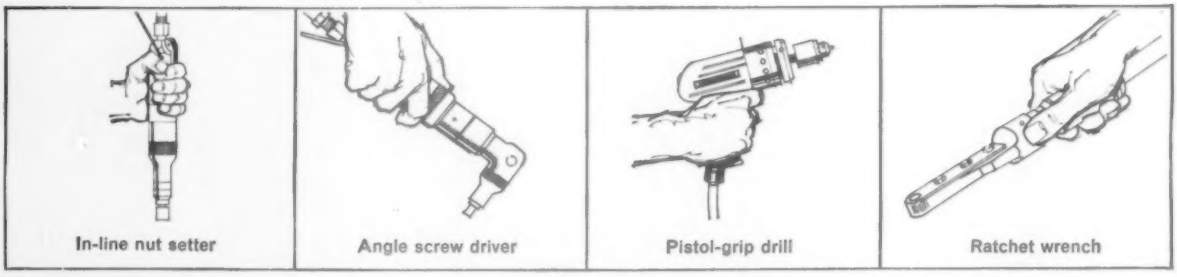


Getting the most from the hands you hire

In tight places as shown above, or where elbow-room is plentiful, Gardner-Denver can provide exactly the right air tool to keep expensive hands working at top efficiency.

Each air motor size provides the basic "building block" for hundreds of different tools—assuring versatility and interchangeability to keep pace with production changes.

For details, see your Gardner-Denver air tool specialist or write for bulletins.



In-line nut setter | Angle screw driver | Pistol-grip drill | Ratchet wrench

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

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For more facts circle 465 on Reader Service Card

Your Guide to the Most Complete Line of Personal Protective Equipment Available

AO Dura-Guard hats or caps meet or exceed all standard specifications. Of all-plastic construction, they may be used wherever dielectric protection is required.

New Durasafe glasses combine latest safety features and sturdy construction with wide choice of fitting qualities, colors and combinations, both plastic and metal.

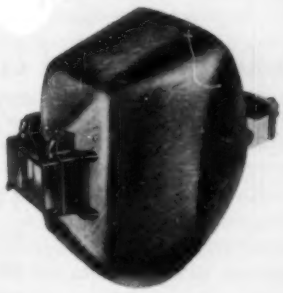
Acid-and-vaporproof suit (Model 6111) of one-piece polyvinyl chloride coated nylon for full body protection. Model 6220 protects against liquid oxygen and nitrogen.

'Red Devil' respirator (R-2090), with variable density filter, is highly efficient. AO offers a complete respirator line, plus portable rescue breathing equipment.

New flexible mask welding goggle (No. 488) is lightweight, cool, comfortable. Standard welding and cover plates fit easily into nylon holder, allow wide-angle vision.

New Paint Spray Respirator. Compact and light in weight, this Bureau of Mines approved unit is one of 17 filter combinations possible with an AO R-5000 series respirator.

AO 710 splash goggles for chemical operations and where humidity is a problem. Protect against spray, splash, flying particles. Full line of flexible mask goggles also available.



No. 9716 fiber glass welding helmet has narrow front, lift front glass holder. Adjustable, all-plastic headgear, four positioning stops. Check AO for full welding line.

For details, contact your nearest AO Safety Products Representative.

Your Surest Protection . . . AO SURE-GUARD Products

American Optical

COMPANY

SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

IDEAS OF THE MONTH

By Lewis Kilquhart, Consulting Editor, FACTORY

For more data, circle item numbers on Reader Service Card next to back cover.

Memo for Spring 1962: If your plant grounds include steep banks, other spots "where grass won't grow," grass mat (*Troy Turf*) combines seed, fertilizer, soil conditioner, organic matter, pH control. Mat's strong enough to stop erosion of even 85-deg. slopes. Choice of 13 kinds of grass. **(236)**

Coffee's hot, cup's not—if it's China-Cote (*Lily-Tulip*). Drinking surfaces are coated with foam polystyrene. Drinker tastes coffee only. Just enough heat comes through to remind him brew's steaming hot. **(237)**

Eyeful of new ways to cut costs with conveyors is what you get from Conveyorama (*Standard*), a new idea-packed brochure. **(238)**

Those microwave "dish" antennas popping up all over may be answer to high cost of plant-to-plant phone calls and data transmittal. Full story in film (*Motorola*) called "Communication Unlimited." **(239)**

Newest slide projector, named Tandem-Matic (*Bell & Howell*), gives still pix flowing continuity of movies. Dramatic "lap dissolve" effect is achieved by changing only certain elements in consecutive slides—for example, lines in graphs or charts, parts of machinery or equipment. One slide slowly fades from screen as another takes its place. **(240)**

High filtration and comfort are combined in 1-oz. masks (*3M*) that are all filter and shaped to stay away from nose and mouth. Masks are re-usable, yet inexpensive enough to throw away after one wear. **(241)**

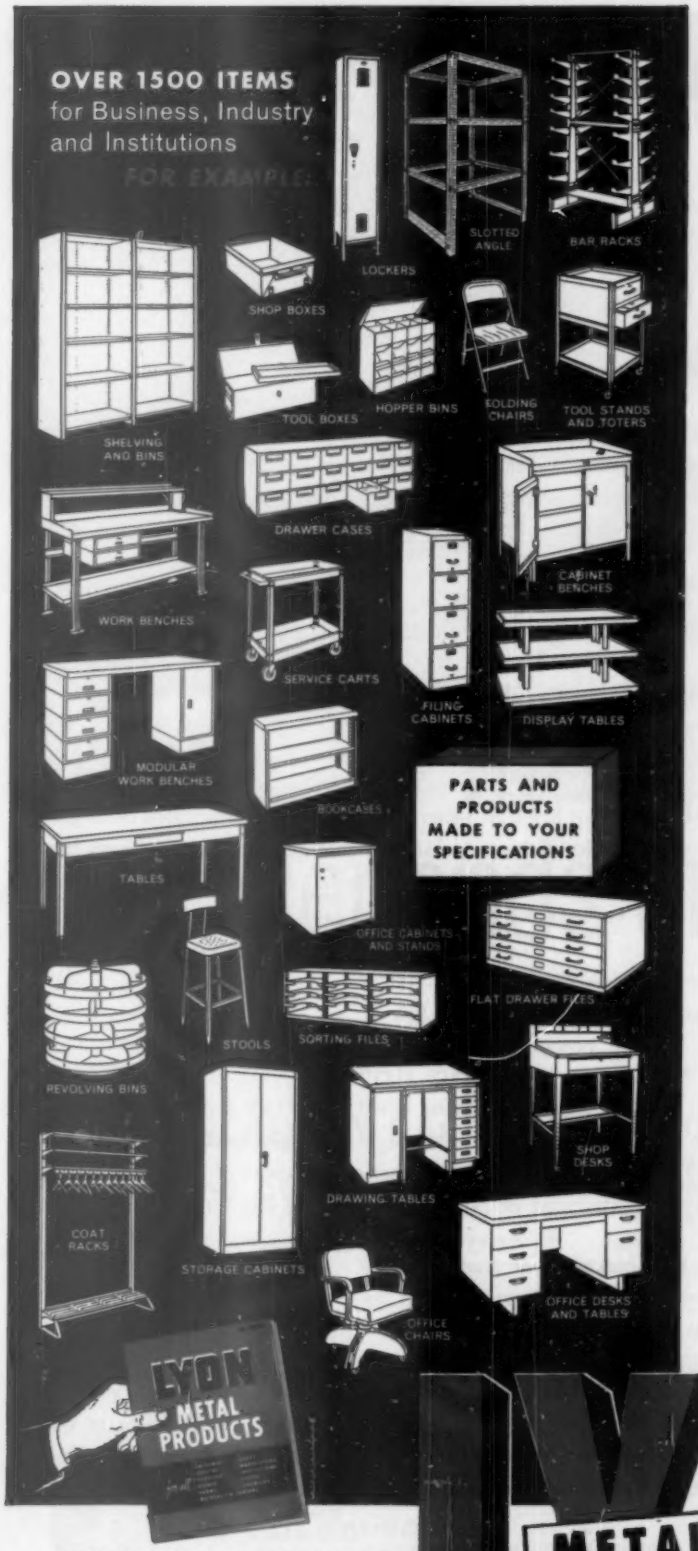
Do's and don't's of cold-weather concreting on 8½x11 card (*Master Builders*) are spelled out in down-to-earth English. Valuable data on use of accelerators, preparation of forms and subgrade, protection and curing, etc. Handy nomograph shows how to control temperature of mixes. **(242)**

Shure-Drive is multi-faced shock-absorbing hammer (*Ramset*). Five interchangeable tips enable user to choose power ranging from sledge-hammer to feather-touch. Tips are colored to identify degrees of hardness. **(243)**

Emergency Lighting Handbook (*Electric Cord*) has 89 pages full of what you ought to know about 6-volt battery-operated units. **(244)**

Extensible paper is uncreped kraft paper that stretches or "gives" up to 15%, can withstand greater impact and shock. New booklet (*Clupak*) cites four more good reasons why it may be the answer for your product. **(245)**

Turn the page



THIS CATALOG ILLUSTRATES THE WORLD'S MOST DIVERSIFIED LINE OF STEEL EQUIPMENT *IT'S FREE!*

5 TO 1

"If your company were in the market for steel equipment such as steel shelving, lockers, work benches, shop boxes, etc., what manufacturers would you consider?"

That was the question an independent survey organization put to key men in companies throughout the country back in 1955. They gave Lyon 5 times more first choice votes than any other manufacturer.

In a comparable survey made in 1960, Lyon's first choice margin increased to 7 to 1—and Lyon received more exclusive mentions than the next twenty-two companies combined!

Your nearest Lyon Dealer offers the world's most diversified and *most preferred* line of steel equipment—quality protected to give you the most for your investment.

LYON METAL PRODUCTS, INC.

General Offices: 1212 Monroe Ave., Aurora, Illinois
Factories in Aurora, Ill.—York, Pa.—Los Angeles
Dealers and Branches in All Principal Cities

LYON® METAL PRODUCTS

For more data, circle item numbers on Reader Service Card next to back cover.

Multi-Mortar is epoxy variety (*Delorme*) that ought to be useful in any maintenance department for bonding masonry of one kind or another. Maker says 12 lb. will do work of 800 lb. of ordinary mortar! **(246)**

How to get out of the truck business is title of handsome brochure (*Hertz*) with parade of companies that have learned how leasing frees management, releases capital, takes over maintenance. **(247)**

Verti-Matic is high-speed conveyor (*FMC*). Vertical and automatic, as name implies. Self-loading and unloading. What we specially like: It's completely mechanical in operation, has just one motor (for maximum efficiency, minimum maintenance), can be readily integrated into existing conveyor system. **(248)**

Where you gonna sleep Jan. 22-25? Better write to your favorite Philly innkeeper instanter—if you're headed for National Plant Engineering & Maintenance Show (*Clapp & Poliak*). Biggest in 13 years, we hear. More than 400 exhibitors at Show, 43 sessions at Conference. Remember, no standing in line if you've sent in your pre-registration card. To get yours, add this number to others you circle on Reader Service Card. **(249)**

Chemisphere, that low-cost spherical tank (*Justin*) fabricated from glass-reinforced polyester, could be the processing or storage unit you're looking for—where corrosive conditions call for high chemical resistance. Weight: about one-seventh that of comparable stainless steel tank. **(250)**

You'll get a good laugh—anyway a smile—out of new 32-pager (*Albany*) showing full line of fasteners plus "gems of philosophy" from lips of boss's son, biggest customer (285 lb.), jovial banker, others. **(251)**

Turn off fluorescents during lunch period? Or leave 'em on? Which is better? One sure way to find out is through new lighting cost reduction plan (*Westinghouse*) based on area-by-area comparison of costs of tubes when lamps are turned off with extra cost of power when they're left burning. **(252)**

Liquid lock for metal parts is how maker (*American Sealants*) describes Loctite. 1961 bulletin shows how it ends breakdowns caused by loosened fasteners, simplifies assemblies, seals joints without heat. **(253)**

Planning calendars give you the long look ahead, keep you from waking up in Chi when you ought to be in Kalamazoo. Your choice of three (*Skokie Valley Design Group*): semi-year (two quarters on each side), omni-year (entire year on one side), omni-month (12 charts, one for each month). **(254)**

Mathematical Handbook (*Curta*) contains many aids to every-day figuring problems. Powers and roots, for instance. Also logarithms, decimal arc tables, conversion factors, etc., etc. Pocket-size. Free, of course. **(255)**

Turn the page

depends on so little...

. . . call on your
ROLLWAY Distributor
for the bearing you want
when you want it!

● *There are more than 400 Rollway Distributors, located to serve you at a moment's notice. Ask your nearest one for a complete product line bulletin or write the company direct. Rollway Bearing Company, Inc., Syracuse, N. Y.*

When down-time costs pile up as a result of bearing failure, bearings become the most important component on the line.

To avoid an excess of such costs, call on your Rollway distributor. He'll get your bearing to you in the minimum possible time . . . calling on the greatest range of sizes and types of straight cylindrical roller bearings available anywhere today . . . Rollway Bearings.

Furthermore, at your request he will furnish competent engineering help on replacement installations.

Solidly behind him stands the long experience and latest know-how of design, manufacture and application that places Rollway Bearings in the most respected machines of today.

You can depend on

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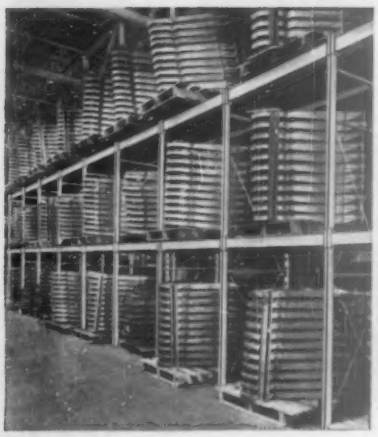
RIGHT!

Yes, "Right" for YOUR particular storage needs in Rigidity-Simplicity-Flexibility and Efficiency!

American

adjustable STORAGE RACKS



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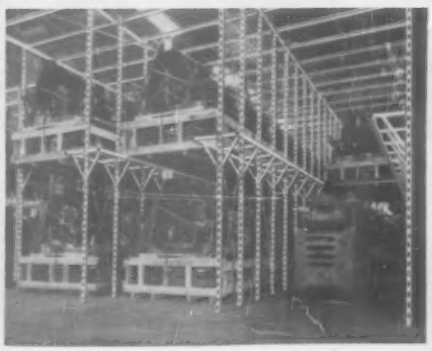

"Right" in Rigidity

Specially roll-formed Posts are extra heavy gage steel —sturdy Stringers are one-piece continuous welded steel tubing—Upright Frames are cross-braced against sway—Turnbuckles "level out" uneven floors.

"Right" in Simplicity

Easy and quick to assemble—no special tools required —no welding or costly bolting—all parts scientifically engineered to hook securely into place.

"Right" in Flexibility

Stringers work independently of any other part—they raise and lower like a window, on 4" centers—make rigid connection when "locked" to post.

"Right" in Efficiency

American Racks use every inch of storage space—they save you time, labor and money from the very start of installation—provide industry's highest safety factor for utmost protection.

AMERICAN METAL PRODUCTS COMPANY

STORAGE RACK DIVISION

5965 Linsdale Ave. amp® Detroit 4, Michigan

Manufactured in Canada by Sunshine-Waterloo Co., Ltd., Waterloo, Ontario

For more facts Circle 469 on Reader Service Card

For more data, circle item numbers on Reader Service Card next to back cover.

Industrial gas data booklet (*Airco*) lists physical and chemical properties of oxygen, nitrogen, argon, helium, hydrogen, carbon dioxide, acetylene, neon, krypton, xenon. Handy conversion tables. 48 pages, pocket-size. **(256)**

Ideas-20 is 16-pager (*Better Packages*) that suggests ways to improve packaging and shipping operations with reinforced gummed tape. **(257)**

Why not Arkansas? Could be right place to locate that new plant on your company's expansion agenda. Anyhow, you'll want copy of new directory (*AIDC*) of Arkansas industries listed (1) alphabetically by company name, (2) by type of product, (3) alphabetically by town. **(258)**

Do-it-yourself aluminum pallet kit (*Brooks & Perkins*) is easily assembled by one man with wrench. Six models, in sizes from 36x36 to 48x48. All have 1-ton load capacity. Pallets weigh from 35 to 59 lb. **(259)**

Foaming problems? Not with defoaming system (*Teknika*) that does trick with sonic energy. No costly chemicals. No settling tanks. **(260)**

Turn the page

All Over America
DIXON PERMANENT-TYPE Flake Silica-Graphite Paints
Give Longer Protection To Outdoor Metal Surfaces

Fourteen years' protection for a major elevated highway, 10 years for a water-sealed gas holder, 15 years for a municipal water tank, only three paintings in 34 years for a grain elevator—these are but a few actual histories of economical longer protection with DIXON Permanent-Type paints for outdoor metals.

More than 100 years of Dixon experience and trial under all conditions of weather, temperature and industrial corrosion have developed the outdoor paints that can cut your costs with longer protection!

Dixon can save you money! Write today and tell us your problem. We'll show you how Dixon has cut the paint protection cost for others.

PAINT PRODUCTS DIVISION
THE JOSEPH DIXON CRUCIBLE COMPANY
Jersey City 3, New Jersey

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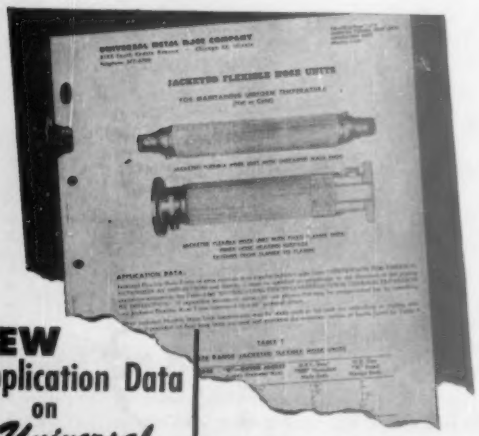
To check diameters of thin-walled parts, there's periphery tape (*Pi Tape*) of spring steel. Large vernier scale is easily read to 0.001 in. Only one measurement necessary for both round and out-of-round parts. **(261)**

Security guard's check-off list (*Pinkerton's*) contains baker's dozen of critical things he should know how to do in emergency. **(262)**

Isolation mounts, anyone? Don't overlook mounting (*Korfund*) with single helical coil-steel spring. Load-carrying capacities from 50 to 540 lb. Four different springs. You insert stiffer one into housing if accessories have been added that increase weight beyond original spring's capacity. **(263)**

Roll-up mats for wet floors (*Emco*) have rubber "feet" that insulate from electric shock, add to natural resiliency of hardwood. **(264)**

Cafeteria managers are giving three times three (we doubt not) for that all-in-one dish dolly (*Cres-Cor*). It has adjustable adapters that divide it into compartments just big enough to hold different-sized dishes. **(265)**



NEW Application Data on *Universal* JACKETED FLEXIBLE HOSE UNITS for thermal control in tank car unloading or piping alignment

This new Application Data Bulletin (IPB-Sec. 7C), just off the press, includes helpful application suggestions, as well as product information. Universal Jacketed Flexible Hose Units are available of carbon steel, bronze, or 304, 316 or 321 stainless steel with threaded male, stub welding, or fixed flange ends. Available in 1¼" x 2½", 1½" x 3", 2" x 4", 3" x 5", 4" x 6" and 5" x 8" sizes.

Request Catalog ID-100E with IPB-7C supplement

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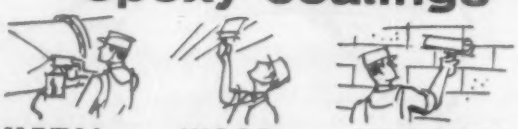
Universal METAL HOSE CO.

2147 South Kedzie Avenue, Chicago 23, Ill.

SPRAY . . . BRUSH . . . ROLL

Adheron* epoxy coatings



METAL . . . WOOD . . . MASONRY

STOP ACID ATTACK

Send for free literature today. Learn how Adheron epoxy products can help you cut maintenance costs. Get *positive* protection against acids, alkalis and corrosive fumes.

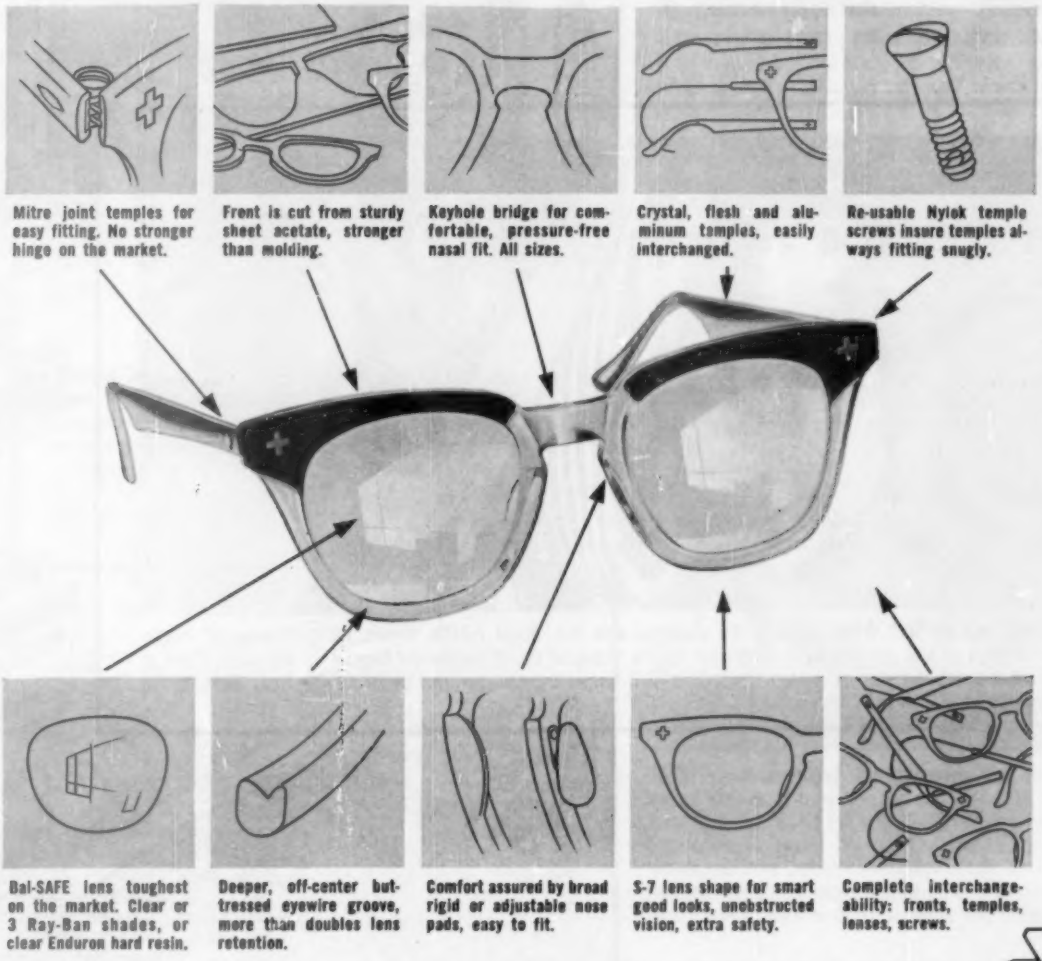
*Proven during more than 5 years of industrial use

Hauger-Beegle ASSOCIATES, INCORPORATED

7250 Franklin • Forest Park, Ill.

IT'S AS IF YOU DESIGNED THE Y-30 LINE

NEW *B&L Safety Glasses combine all the features you want most*



Mitre joint temples for easy fitting. No stronger hinge on the market.

Front is cut from sturdy sheet acetate, stronger than molding.

Keyhole bridge for comfortable, pressure-free nasal fit. All sizes.

Crystal, flesh and aluminum temples, easily interchanged.

Re-usable Nylok temple screws insure temples always fitting snugly.

Bal-SAFE lens toughest on the market. Clear or 3 Ray-Ban shades, or clear Enduron hard resin.

Deeper, off-center buttressed eyewire groove, more than doubles lens retention.

Comfort assured by broad rigid or adjustable nose pads, easy to fit.

S-7 lens shape for smart good looks, unobstructed vision, extra safety.

Complete interchangeability: fronts, temples, lenses, screws.

Here's smart appearance, new strength, built-in comfort, sure economy. Good looks to win workers' esteem. Much stronger frames, including a deeper buttressed eyewire groove which more than doubles lens retention. Wearer comfort assured by Bausch & Lomb expertness in ophthalmic eyewear design. Complete interchangeability and other new features assure real savings in safety eyewear costs. Mail coupon today for full Y-30 information.

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protection + economy + worker acceptance

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Please send full information on your Y-30 line of Safety Frames.

☐ Include new free portfolio "Helpful Hints for the Man Responsible for Safety."

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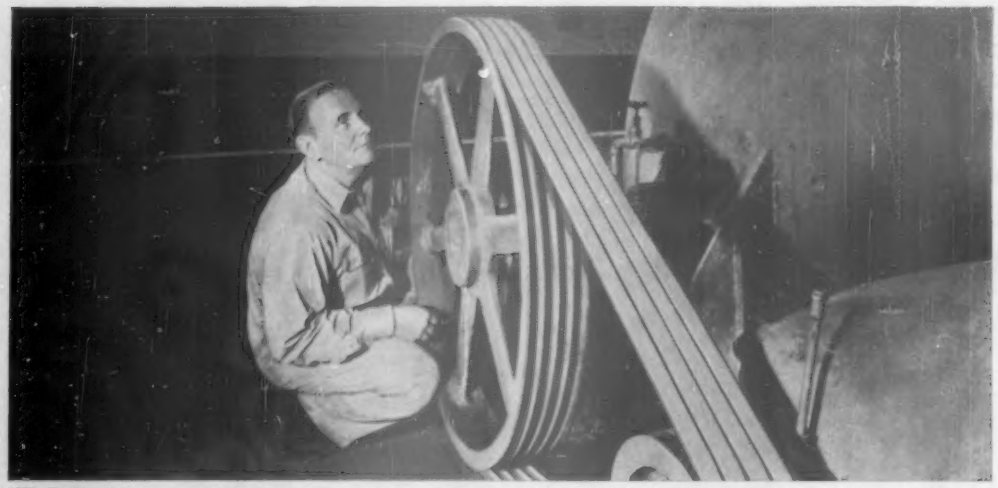
For more facts Circle 473 on Reader Service Card

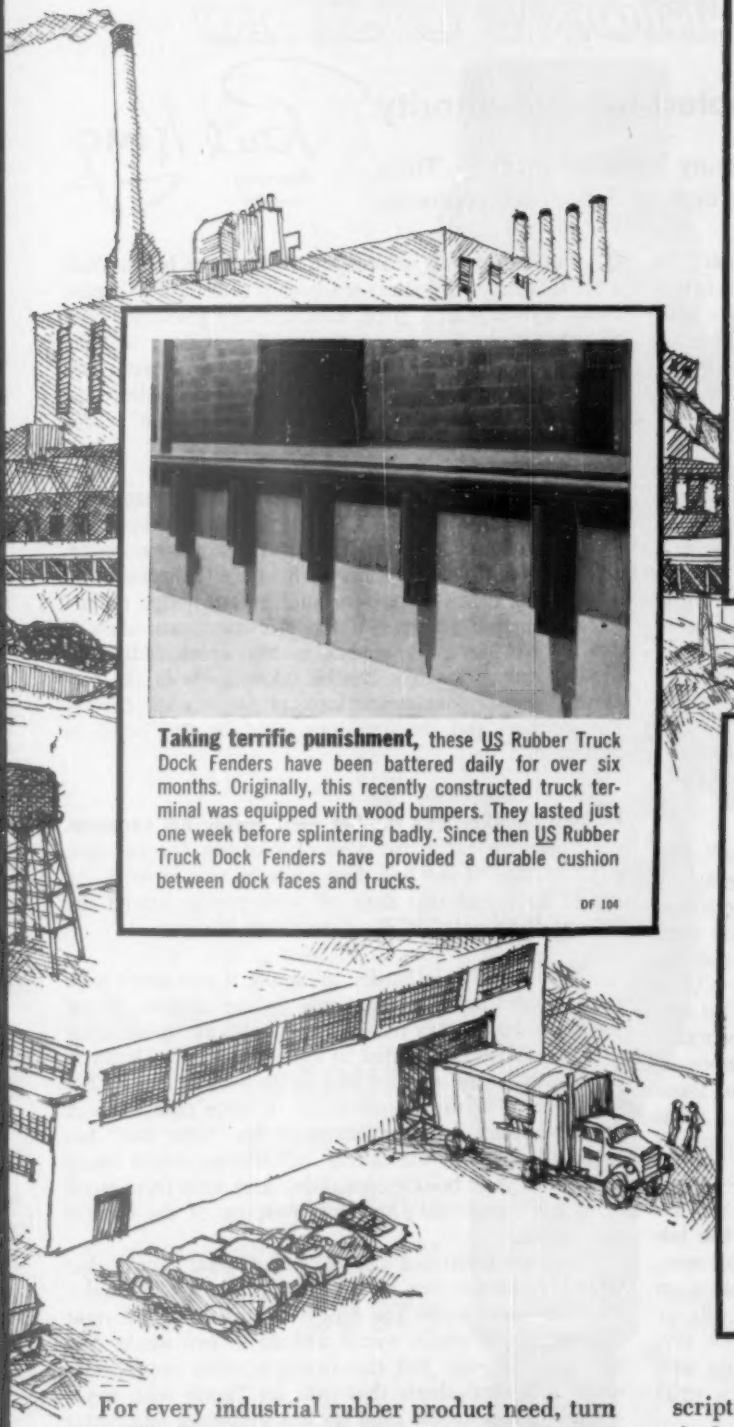
US AT THE HEART OF INDUSTRY...

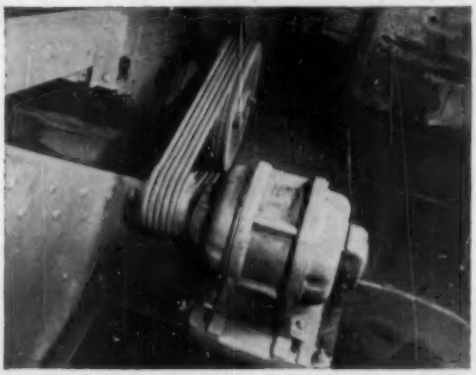


Misfits can't get on this drive because it's equipped with U.S. Royal V-Belts. Known for their superior length-stability, the belts on this job (driving a dynapulper for the Ruberoid Co. of Gloucester City, N. J.) were assembled at random from a distributor's stock, have proven their high torque transmission and dependability from the day they were installed.

VB 116

Manufacturers who seek high performance rely on US...for the rubber products that will contribute the most telling savings on maintenance costs and provide the maximum efficiency. For reliability in rubber, look to the world's largest producer of industrial rubber products.





Known for maximum reliability, safety, and profit, U.S. Royal V-Belts provide top efficiency, exceptional length stability, uniformity and long service life on all types of drives. You'll profit from the driving power of U.S. Royal V-Belts on conveyor, elevator, and loading-boom equipment; crushers, breakers, dryers and pumps; ventilator and cooling fans.

VB 109

Taking terrific punishment, these US Rubber Truck Dock Fenders have been battered daily for over six months. Originally, this recently constructed truck terminal was equipped with wood bumpers. They lasted just one week before splintering badly. Since then US Rubber Truck Dock Fenders have provided a durable cushion between dock faces and trucks.

DF 104

Most recommended for superheated and saturated steam at temperatures to 750°F., US asbestos-base Style 899 Sheet Packing also gives superior service with ammonia, gases, oils, gasoline, some acids, alkaline solutions, and other chemicals. Made of specially selected long-fiber asbestos, Style 899 Sheet Packing won't soften, burn or blow at joints and flanges.

P 103

For every industrial rubber product need, turn to US. For Conveyor Belts, V-Belts, the original PowerGrip "Timing"® Belt, Flexible Couplings, Mountings, Fenders, Hose and Packings . . . custom-designed rubber products of every description. Discover why U.S. Rubber has become the largest developer and producer of industrial rubber products in the world. See your U.S. Rubber Distributor or contact US directly at Rockefeller Center, New York 20, N. Y.

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

United States Rubber

MECHANICAL GOODS DIVISION

LABOR RELATIONS CLINIC

with noted labor authority

Practical advice on labor problems bothering FACTORY readers. Then, on the following pages, comments on current labor developments.

Paul King
Attorney at-Law

Q. A well-known trouble-maker applied for a job with us, but we turned him down. In a previous job he instigated an unsuccessful strike and was fired. We have been getting along well with our union for over 15 years and don't want any rotten apples around. But he might make a stink about our turning him down. Do we *have* to hire a guy like this? *A.Z., Plant Manager.*

A. Well, if he (or the union) doesn't complain to the NLRB, you're home free. But if he does, rotten apple or not, the Board most likely will order you to put him on the payroll. The law says you cannot discriminate against an applicant because of his union proclivities. So the Board could make you hire him, on the theory that not doing so would deter the full and free exercise of your employees' rights. At least, that's how it has ruled in the past.

Q. If union members have the right to strike, why can't the company lock them out before they do so? *B.C.P., Factory Superintendent.*

A. Let's just file that one under "Strange but true." The Supreme Court says the use of economic pressure by the parties is part and parcel of the collective bargaining process. National labor policy contemplates that each party has available to him economic pressures and devices to make the other incline to agree. Yet the NLRB and many federal courts have been ruling that an employer cannot use economic pressure on his workers to induce their acceptance of his bargaining proposals. The use of a lockout by a company is limited to those situations where a surprise strike might create a plant emergency or an economic loss (for example, meat in process might rot).

Q. In the old days, a fellow would stay on the job until he had to be carried out on a stretcher. But now, what with wage continuation plans, health insurance on workers, and even double coverage where the wife or husband works, there is little incentive for a sick employee to return to work promptly. What do you suggest? *M.V.R., Employee Benefits Manager.*

A. Today it's the boss who is carried out on a stretcher —from worrying about how over-generous his employee benefit plans are. A visiting nurse service may prod some of your workers to come back to work. Doing away with double insurance may help. At least it'll cut back high insurance costs. The Cutter Laboratories (Berkeley, Calif.), for instance, has excluded from its health insurance coverage a working spouse or dependent who is covered by another employer.

Q. Our union uses arbitration to pass the buck. With a fat treasury and gutless leadership that tries to please every worker with a gripe, almost every grievance goes to arbitration. We asked the local president why he doesn't refuse to go to arbitration on sure losers, but he says he can't help himself. Under the law he must yield to what the membership wants. Is this true? *C.N., Industrial Relations Manager.*

A. If the union by-laws call for a vote on whether or not a grievance goes to arbitration, he may be right. But assuming no such provision, and no collusion, fraud, or discrimination, union officers may use their discretion in selecting cases for arbitration. As one judge put it: "The principal purpose of the grievance procedure is *not* to provide a framework within which individual desires and complaints can be taken up with the employer." Have your union look at *Stewart vs. Day & Zimmerman* and the decisions cited by the judge in that case.

Q. My bookkeeper's mother died during his vacation. He claims an extra two days of vacation (or vacation pay) because if she had died while he was at work, he would have had two days off with pay to attend the funeral. Is he right? *W.H., Operations Director.*

A. This question is harder to handle if you don't have a union contract or written rule on the subject. If the employee had to stay in bed with a cold during his vacation, would he be entitled to extra vacation? Death in the family is just another one of the vicissitudes of life that each of us must underwrite. If your plant rule or union contract calls for payments for "time lost" because of death in the family, arbitrators would likely argue that your bookkeeper didn't lose time from work (and pay) and that's the only purpose of the funeral pay clause.

Now, an arbitrator could rule (several have) that your bookkeeper has an absolute right to two weeks' vacation—and under the funeral clause he has a right to funeral pay which would add up to two weeks and two days of pay. But this ruling is more appropriate under a funeral clause that calls for "leave with pay." All this points up the need for less sentiment and better draftsmanship of funeral clauses.

Turn the page

Each month Paul King will answer labor relations questions of general interest. No replies will be made other than those published. Write Mr. King, FACTORY, 330 West 42nd St., New York 36.

NEW PRINCIPLE IN TORQUE CONTROL LOWERS ASSEMBLY COSTS

Rotor announces J-42T torque control air impact wrench with new hydraulic amplifier

- **NEW** unique hydraulic amplifier shuts off tool at desired torque. This exclusive device results in...
- **FASTER** rundown and impacting speed. Cuts job time.
- **MORE ACCURATE** torque control with uniform results. Quick, easy adjustment...tamperproof.
- **ASK FOR DEMONSTRATION** of the J-42T to see how this outstanding development can cut costs on your assembly line.

Write The Rotor Tool Company, 26300 Lakeland Blvd., Cleveland 32, Ohio.

Here's the RIGHT TOOL for YOUR job!

ROTOR TOOLS

The Rotor Tool Company · Cleveland, Ohio

SUBSIDIARY OF THE COOPER-BESSEMER CORPORATION

a practical way to save thousands of dollars on your next overhead crane installation

The cutaway drawing above illustrates the new Standard Tiger Crane. The key to cost-saving for you lies in the word "standard." Can a heavy-duty, high-quality overhead crane be a standard item? We, at Whiting, have engineered so many cranes where specifications are similar that we know certain key elements can be standardized.

Here is our frank proposition: If, on your next crane order, you can select a Whiting Standard Tiger Crane, we will be able to deliver it to you with fewer engineering hours and less construction time. Consequently, we can save your firm thousands of dollars. We can deliver faster and we sacrifice nothing in quality. The Tiger Crane is top-quality, top-workmanship throughout.

But please get the full story. It's told in the bulletin —"The Whiting Standard Tiger Crane." Write Whiting Corporation, 15689 Lathrop Ave., Harvey, Ill. In Canada: Whiting Corporation (Canada) Ltd., 350 Alexander St., Welland, Ontario, Canada.

See our catalog in Sweets

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MANUFACTURERS OF CRANES; TRAMBEAM® HANDLING SYSTEMS; PRESSUREGRIP®; TRACKMOBILES®; FOUNDRY, RAILROAD, AND SWENSON CHEMICAL PROCESSING EQUIPMENT

Begins on page 148

LABOR RELATIONS

Q. An employee misappropriated funds during his employment. We sacked him, and the company wants to withhold wages due him to make up for the losses. I have my doubts. Can we do it? *V. N., Labor Relations Director.*

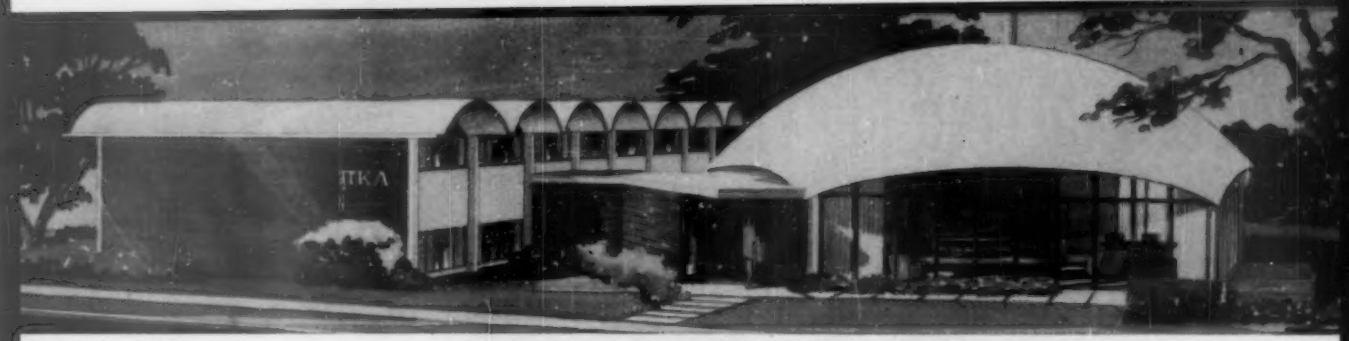
A. Don't try it. The Wage-Hour Division has already put the kibosh on this sort of thing. "It would be a failure to pay the minimum wage," says the Division. Furthermore, "it would be difficult to see how the misappropriation of funds could be regarded as an advance payment of wages." Suggestion: When you lend money to employees or sell merchandise to them, be sure you write up the transaction *as an advance.*

Q. Do employees have the right to refuse to work overtime? *R. O. B., Shipping Manager.*

A. Under most union contracts, no. There may be rules for apportioning overtime or for giving advance notice, but unless your union contract says otherwise, employees can't refuse altogether.

Q. At almost every fourth-step grievance, the legal-eagle business agent talking for the union throws a dozen arbitration awards at us to support his position. Says they represent the majority view. This obligates us to throw a dozen back at him and we have a hot discussion of awards instead of the particular grievance. I thought arbitration awards were not supposed to be used as a precedent. *E. R. B., Labor Relations Manager.*

A. They're not! But it takes a strong-gutted arbitrator to fly in the face of what his better-known compatriots have ruled. Your best bet (when the cited awards are against you) is to show how your facts differ. Also, point out that the cited awards are "published" awards, and that, as Arbitrator Samuel H. Jaffee explained recently, only one in 20 get into print. Publishers select awards based on their interest value, the number of awards on the subject



This free-span dome, housing the fraternity chapter rooms and recreational facilities, has glass walls which have a greater heat loss than solid walls. Radiant heating was chosen since it heats uniformly and holds temperatures for longer periods of time.

SPANGRID Steel Pipe radiant heating system serves Denver's first Geodesic Dome structure

The Geodesic Dome is a new architectural form, and the Pi Kappa Alpha Fraternity House at the University of Denver is one of the first of this type in the United States.

SPANGRID uniformity helps speed installation

Over 4,00[illegible] ft. of SPANGRID Steel Pipe was fabricated for the radiant heating system on the job by two men in less than 60 hours. Pipe was bent on a hydraulic bender with no damage to pipe, weld or finish. The 21-ft. sections were easily welded into the grid and the system was subjected to a 100 psi hydraulic test for 24 hours.

Buy SPANGRID, get quality

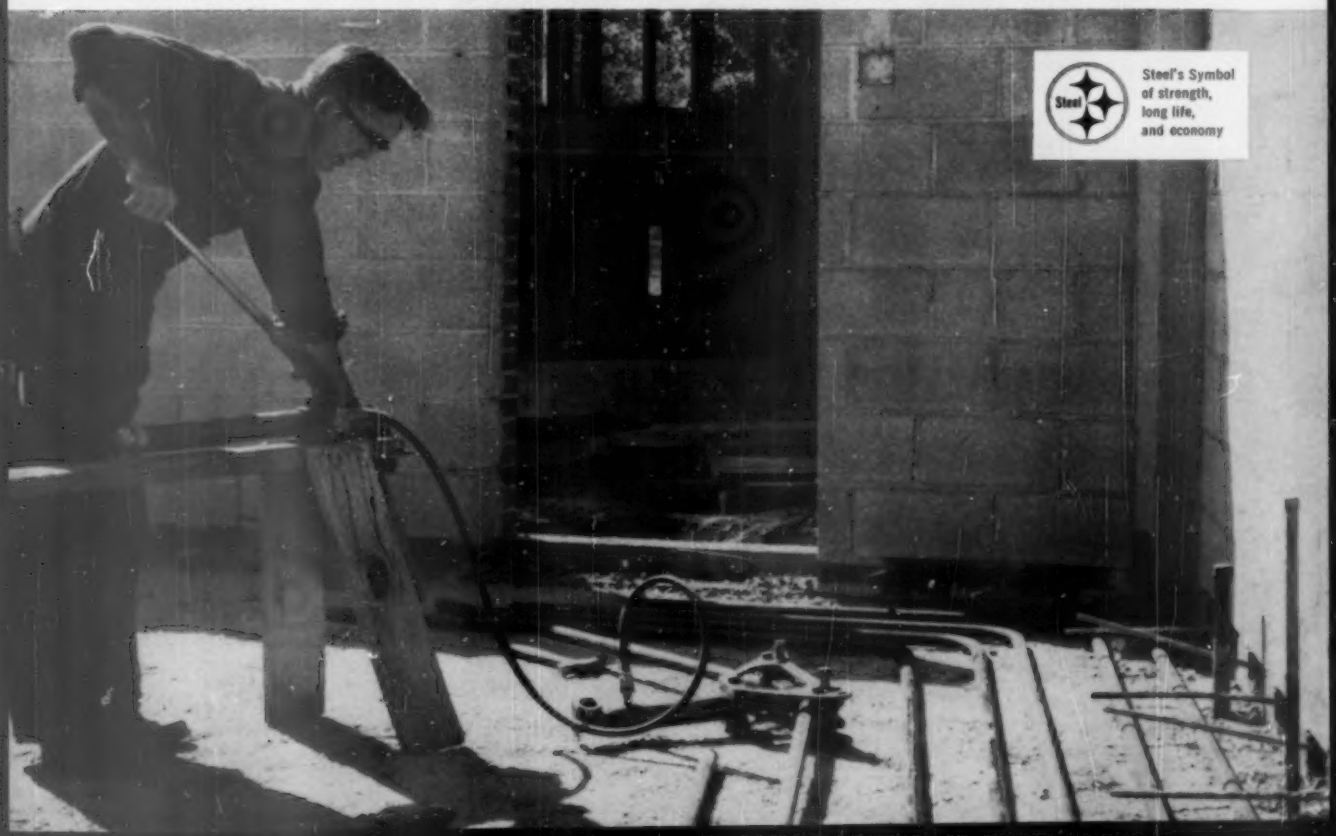
In any radiant heating, snow melting, ice rink or refrigeration installation, SPANGRID Steel Pipe can give you top job-site performance, assure years of trouble-free service. Try it! Your local Spang Distributor will be glad to serve you.

SPANGRID Steel Pipe is one of the many fine steel products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

Architect: Thomas E. Moore, Denver, Colorado
General Contractor: Hugh-Hyder Construction Company, Denver
Heating Contractor: Builders Heating & Air Conditioning Company, Denver
SPANG Distributor: Central Pipe & Supply Company, Denver

ARMCO National Supply Division

SPANGRID Steel Pipe is bent hydraulically. Pipe rests on pea gravel based on 2-inch concrete and is covered with 3-inch finished slab.



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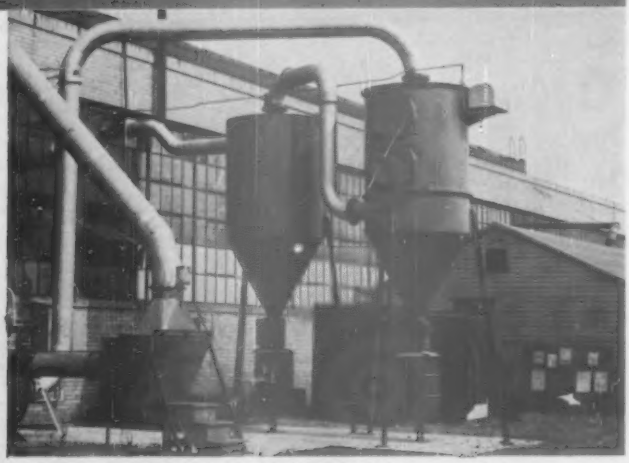


The Bendix Corporation, Eclipse-Pioneer Division

Toxic nature of its dust makes beryllium a "problem" metal to machine. But not here!
Spencer vacuum, piped into a specially designed "clean room", picks up the dust right at the machines . . . whisks it away to filter-equipped separators outside the building.
Result: machining is quicker, safer, easier.

Request Catalog No. 155B, "Spencer Vacuum", or write for recommendations on your particular problem.

Also manufacturers of portable vacuum cleaners and pneumatic conveying systems.

The SPENCER TURBINE COMPANY
HARTFORD 6, CONNECTICUT

Begins on page 148

LABOR RELATIONS

already printed, and the size of their budget that year. Besides, not all arbitrators turn their awards over to a publisher.

Q. I read that management cannot insist on the union posting a performance bond. Is this correct? *L. R. B., Maintenance Manager.*

A. Yes, and as the court decisions now stand, the union cannot insist on an employer putting up this kind of bond.

Q. I think our union outreached Willie Mays when it grieved because one of my supervisors carried several machine parts several hundred feet. It claimed a laid-off union employee should have done it. *C. S., Plant Manager.*

A. We agree. It's what arbitrators would call "de minimis"—not worth fussing about. The laid-off employee might have been a "local" bigshot the union felt obligated to make a pitch for.

LABOR RELATIONS RUNDOWN

Making it hotter—When the shop's icy cold, workers will put the heat on the boss for a warmer place in which to work. Nice, well-mannered, orderly employees, according to a federal court of appeals, will inquire why the shop is cold; then will present their demands for more heat to the proper authority. Poorer-bred workers will merely walk out—as the employees of an aluminum company did. The company matched their bad manners by firing them. The NLRB, arbiter of employee relations etiquette, ruled that the employer had violated the Taft-Hartley Act. But a more conservative federal appeals court had a different picture of the unmannerly worker. It overruled the NLRB.

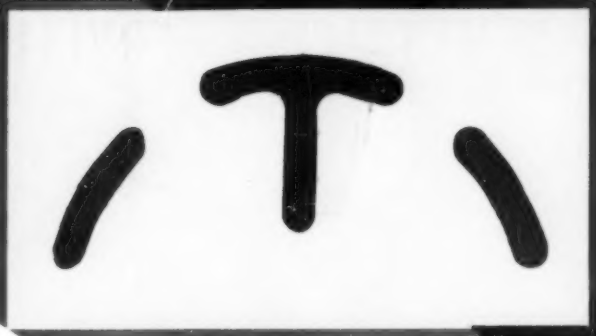
No damages for strike replacements—Replacements were fired when an arbitrator ordered the company to

 For more facts Circle 478 on Reader Service Card Circle 479 on Reader Service Card for items on next page

Introducing a

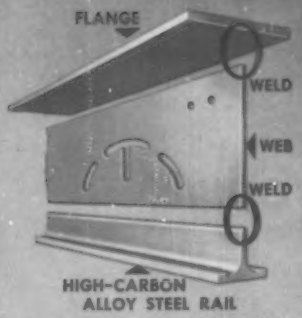
NEW IDEA

in track design



TARCA TRACK

A TRULY SUPERIOR OVERHEAD MATERIALS HANDLING TRACK



Integrally Welded

Automatic welding machinery especially developed for Tarca Track fabrication assures reliable welds. Top flange, web, and high-carbon steel rail are joined by continuous welds to form a one-piece dependable unit.

Tarca Track—an outstanding, new Cleveland Tramrail development. Different from all other overhead materials handling tracks. Result of years of extensive research and testing.

Tarca Tracks are straight and accurate. Not subject to distortions and broad dimensional variations of ordinary tracks fabricated from standard mill beams.

Tarca wearing rails are hard. Made of high-carbon alloy steel integrally welded into a composite track section.

Tarca running treads are flat, raised, smooth. Enable easiest load movement —provide extra wear—prevent peening.

Tarca Tracks have great rigidity because all welds are continuous.

Tarca Tracks are faster, easier to erect. Greater track accuracy simplifies installation. New support fittings save erection time—facilitate track leveling —provide flexibility to relieve stresses from alignment variations.

Ten Standard Sizes—Tarca Tracks range from 8 to 20 inches in depth. Special sizes can be made to suit unusual requirements. Track parts easily proportioned to provide balanced design for any load condition.

Ask for this helpful booklet—No. 2032

Covers all major features the buyer should know about overhead materials handling equipment. Has complete story on Tarca Track. Contains detailed equipment specifications and handy proposal evaluation form.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO
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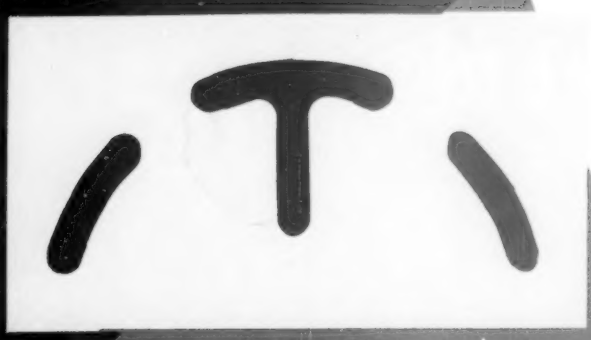
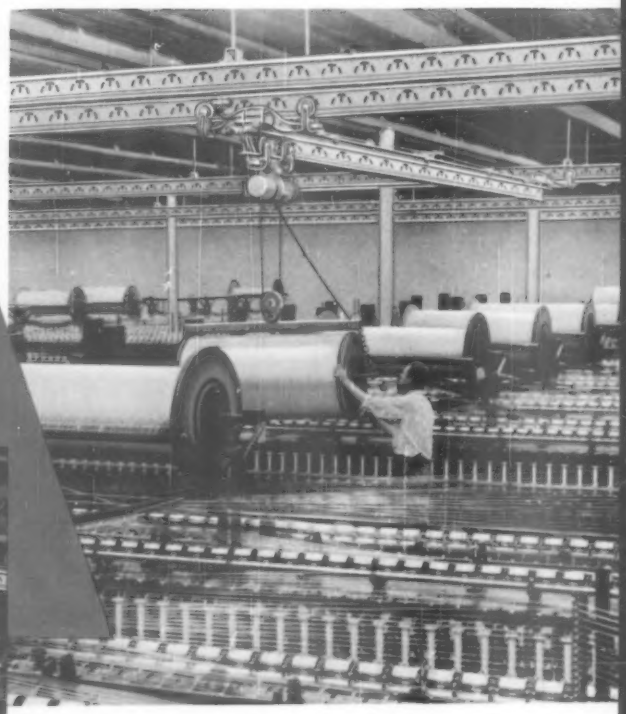


Trade—mark of durability and strength —punched into all Tarca Tracks.



Many hundreds of textile mills have depended for decades upon Cleveland Tramrail for a great part of their materials handling equipment. Illustrated is a Tarca Track crane system handling twister beams.

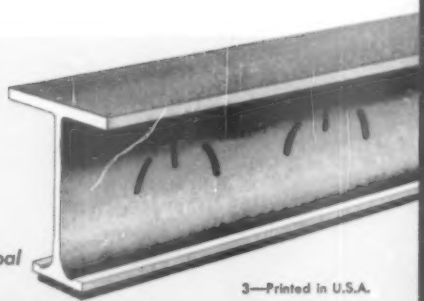
Nearly all of the great American and Canadian automotive plants have installations of Cleveland Tramrail. Many include thousands of feet of track and hundreds of cranes.

Cleveland Tramrail is a leader in automatic materials handling. A great variety of installations are in service. They operate between two or more points on the same or different elevations, or between buildings, as illustrated. One system serves 126 stations.

Your Cleveland Tramrail Sales Engineer is Qualified to give you the Complete Design and Application Story on This Revolutionary

NEW TARCA TRACK

Cleveland Tramrail is represented by competent, experienced engineers in all principal cities of the United States and Canada. Contact address on other side.



3—Printed in U.S.A.

Begins on page 148

re-employ striking employees. "You promised us permanent employment" argued the discharged replacements. "We'll sue!" They did—and lost. The federal district court (in Iowa) ruled that contracts for "permanent employment" can be terminated by either party at any time unless the employees have furnished "consideration" other than a mere promise to work. "Other consideration" must be more than just giving up other employment or incurring moving expenses in reliance on the company's promise of permanent employment.

Labor relations primer—A fast-moving booklet in a fast-moving field for fast-moving supervisors.

This just about describes the Bureau of National Affair's new "Primer of Labor Relations" ($1, 1231 24th St., N.W., Washington, D. C.). With it to refer to, current NLRB decisions fall in place quickly and the plant boss who has more things to do than worry only about labor relations can keep that phase of his knowledge in proper perspective. The pamphlet covers the field in 91 pages including a 13-page glossary of labor terms.

Pay for waiting for the doctor—Employees must be paid while waiting for the company doctor to look them over, ruled Arbitrator Burton Turkus. Such time should be counted as hours worked "when (a) the time . . . falls within the employee's regular working hours on a day when he is actually working, and (b) he receives such medical aid on the employer's premises or at the direction of the employer."

Data processing department in clerical unit—When modern data processing machines take over payroll, accounts receivables, sales and cost analyses work, the employees operating the machines are still part of the old office-workers unit, the NLRB advised the Sperry Rand Corporation. According to the Board, "the employees in the department exercise much the same skills and enjoy substantially the same employment benefits as the office clerical employees in the exist-

ROPER PUMPS

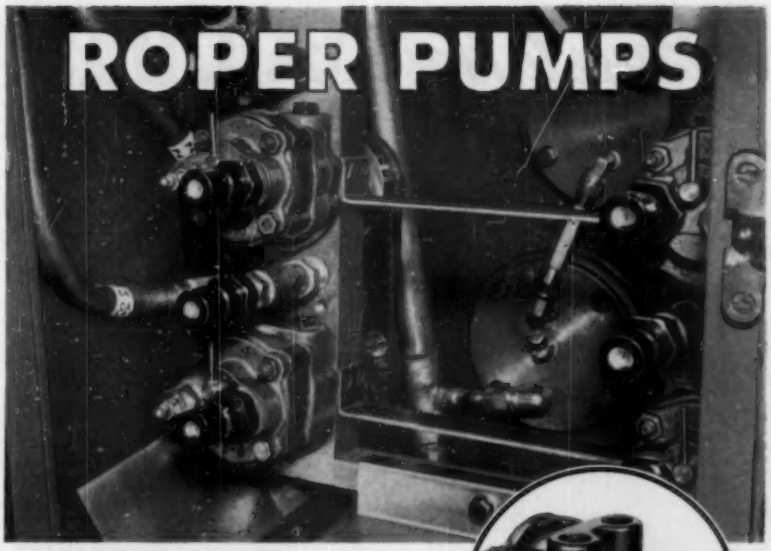
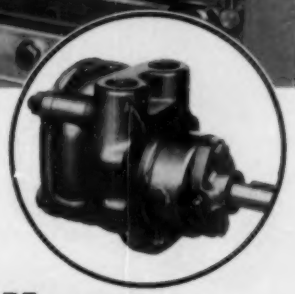


Photo courtesy R. Hoe & Co., Inc.



SERIES K FIGURE 17K3

dispense inks to individual rollers on high-speed press

• SERIES K SIZES: ¾-110 GPM • PRESSURES TO 400 PSI

This Colormatic printing press, manufactured by R. Hoe & Co., Inc., is equipped to print multi-colored inks at one press run. These inks range as high as 10,000 SSU in viscosity, and are dispensed to individual rollers at 1½ gpm under 20 psi pressure by custom-modified Roper Fig. 17K3 pumps. The four pumps on each press are manually switched into operation and are belt-driven. Valving arrangement on the pumps allows the pressman to switch from ink to solvents when cleaning the press rollers. Series K pumps are adaptable to a wide range of jobs, such as pressure lubrication, hydraulic service, fuel supply, or general transfer work. They are self-priming, and operate with equal efficiency in either direction of rotation.

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- One-piece, heat-treated case-hardened steel drive gear and shaft and the heat-treated driven gear run quietly in axial hydraulic balance.
- Dowel pins and shaft holes precision-bored in one machine setting for accurate manufacturing control.
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- Bearings are special wear-resistant bronze in standard fitted pump. All-iron units have Meehanite sleeve bearings and idler shafts.

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Trust Goodall craftsmen to build into every length of hose they make, the extra measure of strength and durability that means longer, more reliable, more economical service. Here are some leaders in the line you can use with profit.

STEAM. "Inferno"—The best-known hose in its field for all high-pressure, high-temperature applications, including steam cleaning, degreasing and fire smothering.

AIR. "Brown Cord"—for all types of pneumatic tools. Lightweight, flexible. Tough, wear-resistant cover. Oilproof tube.

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HYDRAULIC. Goodall Hydraulic Hose will give outstanding service on your high-pressure control lines, greasing equipment and constant feed lubrication systems. Available plain or as complete Hose Assemblies.

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Begins on page 148

LABOR RELATIONS

ing unit. The department performs essentially the same functions that were performed previously by employees in the bargaining unit."

Accident-prone drivers—How many auto and truck accidents justify discharge of a driver? There's no hard-and-fast rule. When you sack a man for unsafe driving, you play arbitrator roulette.

Take this recent case of a trailer-truck operator. His record:

- Four accidents in about four years which cost his company over $18,000 in repairs (and one person had been killed).
- Three traffic violations in about the same period.
- When 17 years old, he had been involved in a fatal accident with a judgment against him of $25,000.

The company fired him; an arbitrator reinstated him.

Arbitrators are all over the lot in this type of situation, however. There seems to be no unanimity of opinion. Discharges have been upheld in the following cases:

- A bus driver who had a bad record of minor accidents and one serious accident.
- A truck driver who had a third accident and who habitually drove at excessive speed.
- A driver-salesman who had his sixth accident within three years.
- A driver who had a seventh accident within five years, the last four within a three-month period.

Discharges have been denied in these cases:

- A driver involved in an accident that caused several deaths, even though there was evidence of violation of safety rules.
- A tractor-truck driver who collided with a gasoline truck causing a loss of $30,000—even though he had failed to take action that might have prevented the accident.
- A driver who had two accidents in six months, and who was at fault in the second (company: Safe Bus Company).

In sifting through the most recent awards, these principles seem to emerge:

Progressive penalties, like warnings and suspension before complete discharge, have only limited applica-

Begins on page 148

tion—transport drivers of heavy tractor-trailer equipment. They cover hundreds of miles daily according to a schedule that must be adhered to regardless of weather.

The mere absence of fault on the part of the driver is not enough to exonerate him. This is especially true if the driver neglected to do all he could to avoid an impending accident, even though the other driver was clearly at fault. If the company had the burden of proving that the accident was clearly due to the fault of its driver, a high standard of safety might be difficult to maintain. Often it's hard to fix blame in a highway accident.

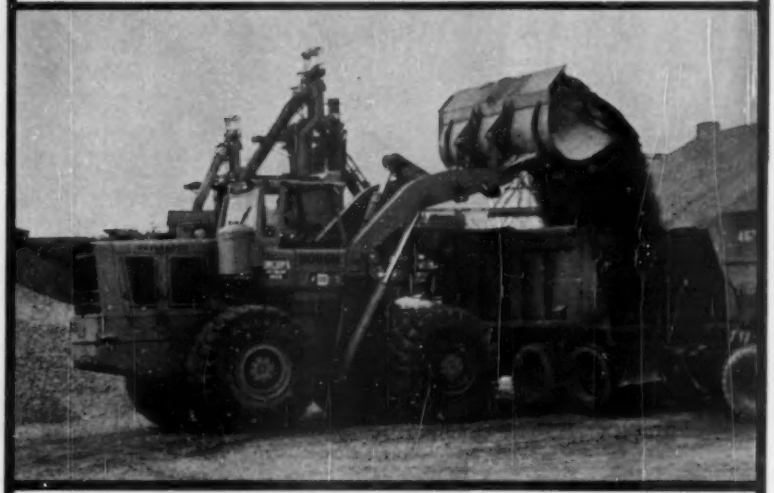
A professional driver may well be expected to be highly skilled in "defensive driving." So the very fact that a driver has a series of serious accidents, regardless of his innocence, may provide *prima facie* grounds for discharge. . . He should have been better at "defensive driving."

But having announced these principles, an arbitrator still called for reinstatement of a driver (but without back pay). Summing up his reasoning:

- Driving conditions—not carelessness—may have caused the mishap.
- A driver who must go out in storm and sleet should be given the benefit of the doubt.
- The company didn't have established procedures and policies covering discipline practices in accident cases.

Beware the employee committee—Sometimes junior boards of directors and employee advisory committees get you closer to finding out what the worker wants. But very often the only result is getting you closer to a Taft-Hartley Act violation. In 1959, the U. S. Supreme Court agreed with the NLRB that a worker committee set up by the company for making recommendations to management is a labor organization—and domination by the company is against the law. NLRB now calls an employee committee "a labor organization" and company-dominated if its only function is to submit its "views"—not recommendations—to supervisors.

Big rubber-tired loader



handles slag "more efficiently"

Until recently, loading operations at the Edward C. Levy Company in Detroit were handled with power cranes and shovels. Now the company is using "rubber-tired tractor-shovels with greater efficiency", according to E. J. Connelly, Director of Procurement.

The Levy Company has six plants in the Detroit area processing slag derived from three steel plants for use in concrete and bituminous paving. Their present tractor-shovel fleet includes four HOUGH units.

The economy of using rubber-tired loaders in handling this material is apparent as Mr. Connelly explains: "We have been able to replace individual yard cranes because we can use the H-120B PAYLOADER at as many as three plants in one day. That's at a radius of 15 miles from our main plant. Even within the plant itself, the machine has to move quickly from one stockpile to another. The H-120B works as many as 16 hours on some days."

You have to see the H-120B in operation to appreciate its outstanding performance. Powered by a 300 h.p. diesel engine, it has an operating capacity of 14,500 lbs., and travels at speeds up to 26 m.p.h. Power assist on all controls — steering, braking, shifting — makes it a dream to operate. Superior design features give it operating advantages of long reach, high dumping clearance and better visibility for the operator.

Why not analyze your bulk handling methods? Chances are a PAYLOADER of the proper size will provide important savings and increase the efficiency of your plant operation. There are 9 sizes and 15 models to fit any of your requirements. Contact a HOUGH Distributor near you, or return the coupon for more information.

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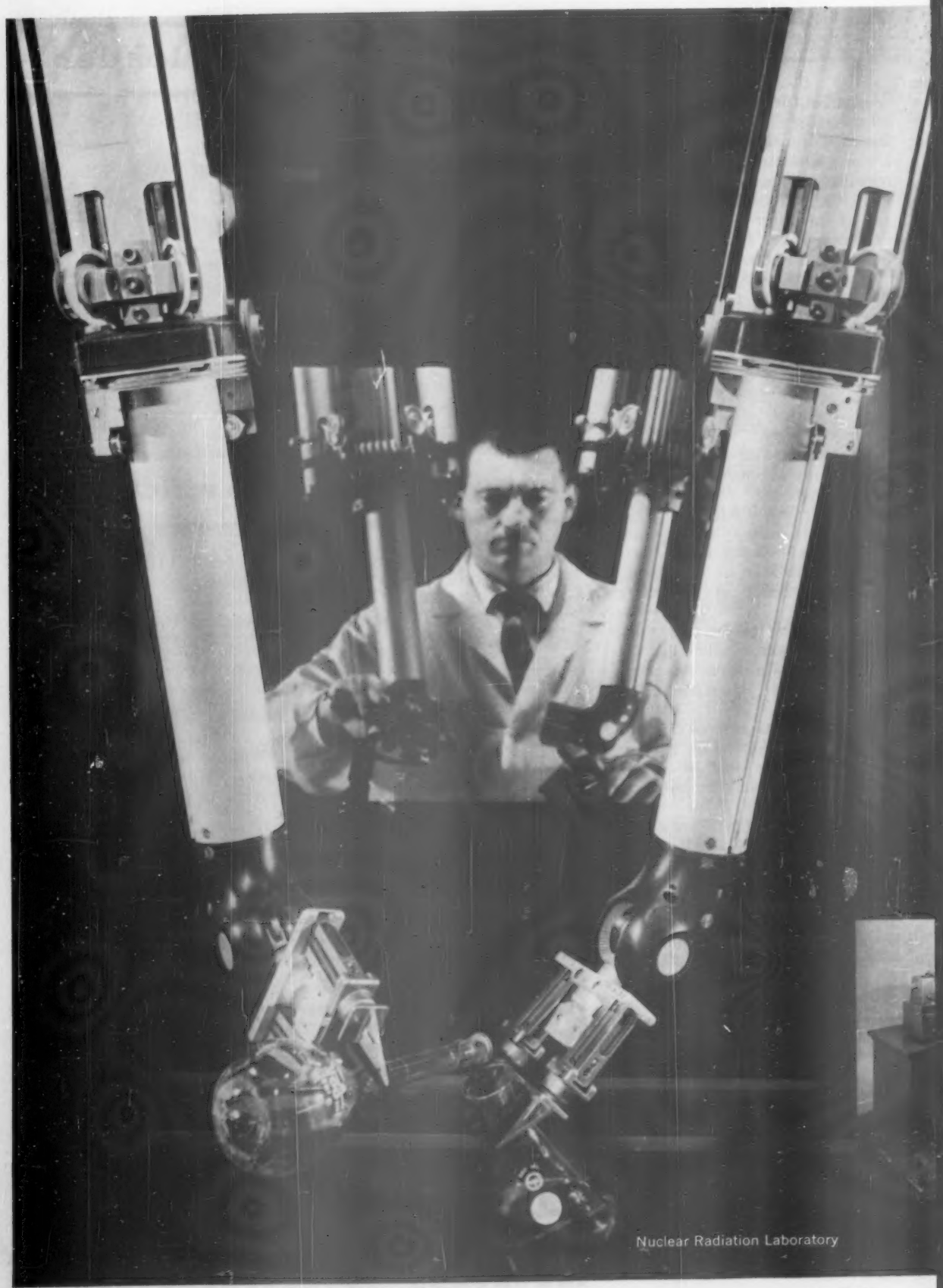
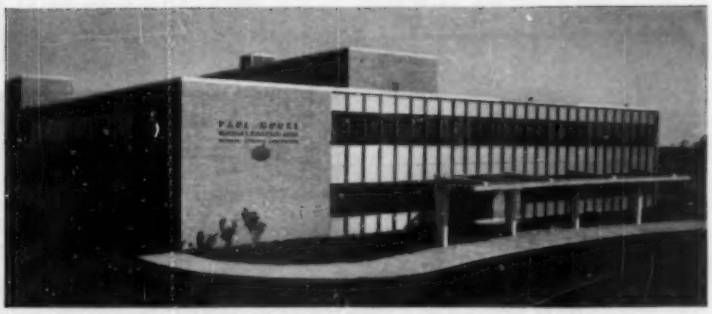


Nuclear Radiation Laboratory

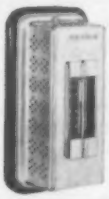
Marr & Holman, architect-engineer

Walter Kidde Constructors, Inc., general contractor

J. E. Schecter Corporation, mechanical contractor



Paul Moore Research & Development Center, Republic Aviation Corporation, Farmingdale, L. I., New York.



CLIMATE FOR PROGRESS

Johnson Control Regulates Air Conditions at Republic Aviation's New R & D Center

Said to be the only fully integrated research complex engaged in every vital area of space investigation, Republic Aviation Corporation's new Research & Development Center comprises eight highly-advanced laboratories: Space Environment and Life Sciences, Re-Entry Simulation, Fluid Systems, Guidance and Control Systems, Materials Development, Nuclear Radiation, Electronics, and Wind Tunnels. The $13 million structure contains over 150,000 sq. ft. of floor space.

Both the nature of the work and the comfort and efficiency of the professional staff require a closely controlled thermal environment. Here, as in other buildings at the Republic plant, a specially planned Johnson Pneumatic Control System provides flexible, precise regulation of air conditioning. Whether it's a private office, a drafting room, or one of the laboratories, Johnson Control maintains the exact conditions required at all times.

Johnson Pneumatic Control Systems are applied to all types of air conditioning, heating, and ventilating equipment and to a wide range of industrial processes. Each system is engineered and installed to meet the specific requirements of the individual plant. Next time you are considering controls, investigate the advantages Johnson Control offers — in performance, reliability, and operational savings. Johnson Service Company, Milwaukee 1, Wis. 110 Direct Branch Offices.

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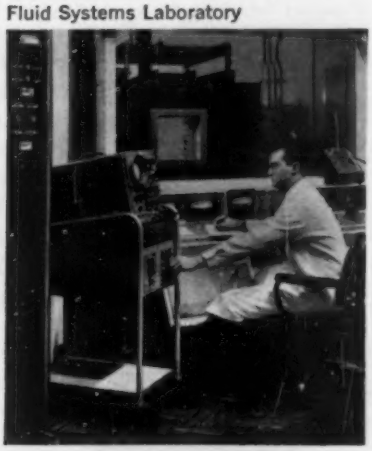

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"During a seven-month period before using LUBRIPLATE No. 130-AA in the bearing of our Kraft Mill Lime Kiln, we used a conventional oil at a cost of $2,134.00. In the seven months that followed, we used LUBRIPLATE No. 130-AA for initial filling and replacement at the cost of $35.84."

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For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

CATALOG NEWS

For more data, circle item numbers on Reader Service Card next to back cover.

PRODUCTION

1—Drilling machines. This 16-page catalog illustrates and describes 6- and 8-spindle automatic hydraulic turret machines. Covers optional features and attachments; shows special machines built from components. *Burgmaster Corp.*

2—Processing machines. Here's a 20-page bulletin that covers multi-station automatic assembling and processing machines. Information on standard and special automation machines, and indexing machine chassis. *Swanson-Erie Corp.*

3—Spot welder. Maintenance, construction, and other data on portable resistance-type welder with built-in timer are set forth in 4-pager (Form WB-961). Welds sheets, rods, bars, and studs in many sizes. *Ace-Sycamore, Inc.*

4—Tooling, accessories. Construction details, specifications, and the like, are given in 16-pager (No. D-540). Products include arbors and sleeves, adjustable drawkeys, angle plates, stop jacks. *Giddings & Lewis Machine Tool Co.*

5—Filtration equipment. Permanent magnetic devices that provide continuous protection for liquid lines are described in 6-page bulletin (No. B-38). Illustrates ferrous traps, slurry drums, and ferrous cleaners. *Eriez Mfg. Co.*

6—Infra-red ovens. Temperature-rating method of automatically providing the right oven answer to electric infra-red heating problems is discussed in 16 pages (BRG-115). Lists 540 vertical, 144 horizontal models. *Radcor, Inc.*

7—Drill heads. Catalog DHF (16 pages) describes gearless crank drive multiple-spindle head for drilling, reaming, tapping, and boring. Explains relation of heads to automation; suggests product applications. *Zagar, Inc.*

8—Infra-red equipment. Bulletin 31361 has 8 pages on application of gas infra-red equipment for preheating, moisture removal, paint baking and curing. Shows 18 different oven installations for many processes. *Hupp Corp.*

9—Fasteners. Fastening principle is discussed in Bulletin No. 359 (32 pages). Types include one-piece fastener designed for a number of functions in addition to primary fastening job. Application data. *Tinnerman Products, Inc.*

10—Templets. Here's a 36-page supplement to company's present catalog of Repro-Templets of machine tools; shop, material handling, and office equipment. New booklet covers about 2000 additional items. *Repro-Templets, Inc.*

BUILDING

11—Metal roofing, siding. This 8-page manual describes the most efficient method of handling and installing protected metal roofing and siding. Includes special unloading and storage, as well as handling methods. *Bowman Steel Corp.*

12—Steel flooring. Applications and installation instructions, safe loads, and other information are given in 8-page bulletin. Lists advantages of Small Pattern 4-way safety plate for various uses. *Joseph T. Ryerson & Son, Inc.*

13—Partitions. Here's an 8-page catalog with specifications, detail and elevation drawings, and photos of company's movable, free-stand, and other partitions. *Rockaway Metal Products Corp.*

14—Acoustical materials. Catalog No. 62 (30 pages) covers 440 types and qualities of products ranging from perforated wood fiber acoustical tiles to integrated air-conditioning-ventilating acoustical ceilings. *Elof Hansson, Inc.*

Turn the page

AUTOMATIC MACHINE PACKAGING

AVISTRAP goes automatic. This is the new, completely automatic Avistrapper machine. Two models available strap packages ranging from 6″ x 6″ to 36″ x 36″ or equivalent cross section. Model AVM-1 shown during 8-month field test, in the shipping department of a large publisher, is strapping cartons and bundles of books for overseas mailing.

Simple. To strap carton, operator places it on Avistrapper table against yoke.

Safe. AVISTRAP is applied and sealed at pre-set tension by pressing foot pedal.

Speedy. One operation does it. No adjustment for different-sized packages.

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New machine-strapping convenience . . . added to new strength and safety. Now you can use AVISTRAP economically on a wider range of packaging jobs. You can operate a safer packaging line, and give your customers packages that are safer to handle and easier to open.

AVISTRAP will actually hold a package together through shocks that break comparable-width steel strapping. And since AVISTRAP is made of high-strength Avisco® rayon, it cannot cut hands, and will not sliver or lash out if broken. It is easily removed from packages, and causes no waste-disposal problems.

Automatic Avistrapper machines can be adapted to apply AVISTRAP in widths from ¼″ to ¾″, and can be custom-built to fit your packaging line. Avistrappers cost less than comparable steel strapping machines, and an Avistrapper runs four times as long on one 80-lb. AVISTRAP coil than a steel strapping machine with a 100-lb. coil. Local service is available in all major industrial communities. Write for descriptive bulletins or to arrange a demonstration.

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Begins on page 160

CATALOG NEWS

For more data, circle item numbers on Reader Service Card next to back cover.

MATERIAL HANDLING

15—Lightweight conveyor. Bulletin No. 600 (6 pages) presents information on multi-purpose, electrically driven conveyor. Carries loads horizontally or on an incline, and is fully portable. Optional attachments. *Conveyor Systems, Inc.*

16—Storage racks. Rugged construction and simple assembly are features pointed out in 8-page catalog (No. 661). Includes tables of upright frame and beam selection guides, diagrams, application photos, accessories. *Storack Corp.*

17—Packaging. Material handling manual provides help on difficult packaging problems. Explains suspension system that minimizes and distributes impact shock. *Herculite Protective Fabrics Corp.*

18—Systems controls. This 8-page brochure (No. 61-1) covers controls for dragline, power and free, monorail, overhead, and roller conveyors. Includes automatic dispatching techniques, data on memory units, etc. *Control Engineering Co.*

19—Lifting magnets. Two bulletins: No. 1032 (6 pages) gives sizes, strengths, styles to fit any tramp iron removal application. No. 3022 (8 pages) lists over 50 styles of circular, rectangular lifting magnets. *Indiana General Corp.*

20—Lifts, ramps. Here's a 6-page booklet (No. 861-1) that tells about automated oil hydraulic equipment for every heavy-duty raising and lowering job. Photos of production lifts, dock ramps, and flexodock ramps. *Autoquip Corp.*

21—Cranes. Specifications and structural features of heavy-lifting, full-revolving, all electric cranes are given in 12-pager (No. 540). Describes models with capacities from 150 to 16,250 ft. tons. *R. G. LeTourneau, Inc.*

22—Collapsible containers. Information about welded wire Cargotainer models and other material handling products is contained in 16-pager (No. C101). Details of eight time and money-saving applications. *Tri-State Engineering Co.*

23—Conveyors. Catalog MF-100-A (8 pages) contains design and application data on portable and adjustable conveyors, hinged steel belt, and custom conveyors from off-the-shelf components. Describes Chip-Tote model. *May-Fran Mfg. Co.*

24—Fork truck. Specifications, dimensions, travel speeds, etc., are given in 4-pager (SS-207). Includes scale drawings of these 2000-lb., gas-powered, cushion-tired fork trucks. *Clark Equipment Co.*

25—Crane. Bulletin No. 95 (6 pages) describes new heavy-duty unit built to standard design with basic components. Capacities of Standard Tiger crane range from 5 to 30 tons. *Whiting Corp.*

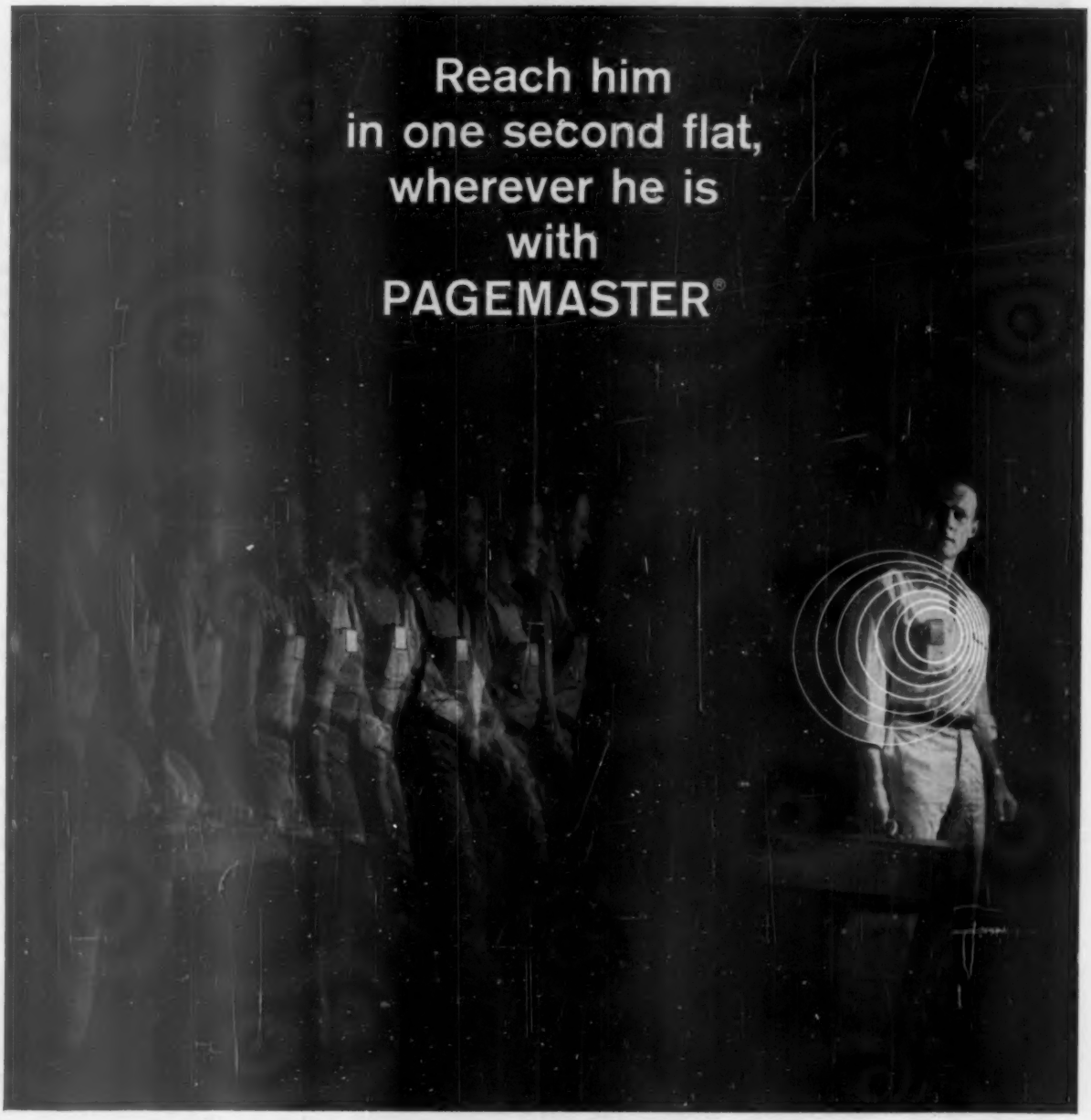
MECHANICAL

26—V-belt drives. Bulletin A695A (42 pages) describes advantages of newest drives consisting of narrower and more powerful belts and sheaves. Three basic sizes for horsepowers ranging from fractional to 1500. *Dodge Mfg. Co.*

27—Accumulators. This 80-pager has details and pictures on line of floating piston cylindrical accumulators. All are for operating temperatures from −40 to +180 F. Also covers gauging assemblies. *Superior Pipe Specialities Co.*

28—Bearings. Here's a comprehensive catalog that provides data on Lube-Align bearings. Features a one-piece, self-aligning, integrally cast spherical self-lubricating bronze bearing in aluminum housing. *Bronze Bearings, Inc.*

Turn the page



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Begins on page 160

CATALOG NEWS

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29—Differentials. Brochure No. 8101 presents design and general information, as well as test report, on precision mechanical differentials. Types include spur, screw, and bevel gears. Has 27 drawings. *Dynamic Gear Co., Inc.*

30—Hydraulic filters. Bulletin 61-78 (4 pages) describes suction-line hydraulic filters. Degrees of filtration are from 74 to 238 microns, and for flow rates from 0 to 120 gpm. *Vickers, Inc.*

VALVES, FITTINGS

31—Vacuum valves. Booklet No. 328 (8 pages) contains information on three-way high vacuum valve designed to serve as master control in systems using diffusion and mechanical pumps. Cutaway views, diagrams. *Central Scientific Co.*

32—Valve systems. This 20-pager (No. 618) is a design manual on equipment for remote control of valves. Details on selection of flexible shaft controls; installation, dimensional, other data. Diagrams and photos. *Stow Mfg. Co.*

33—Couplings. Simplified selection of quick connect/disconnect couplings is shown in comprehensive Catalog No. 60-A (62 pages). Includes guide that lists more than 575 fluids and gases, tells which seals to use. *Snap-Tite, Inc.*

34—Gate valves. Bulletin No. 302 (8 pages) describes rubber-seated gate valve. Outlines areas where valve is used, tells how it works. Includes dimensions, actuators, accessories. *DeZurik Corp.*

35—Ball valves. Information on manually and pneumatically operated ball valves is given in 32-pager (No. 1200A). Shows two basic valves—top-entry type; valve with one-piece bar stock body, end adapters. *Hills-McCanna Co.*

Begins on page 160

CATALOG NEWS

For more data, circle item numbers you want on Reader Service Card.

36—Valve sizing. "A Practical Look at Valve Sizing" (4 pages) explains what occurs in undersized, oversized, and correctly sized pressure-reducing applications. Gives typical example. *Jordan Valve.*

MAINTENANCE

37—Plant maintenance. This 4-pager (P-9614) gives information on maintenance materials and equipment. Covers machine and floor cleaning, overhaul of machines, equipment, etc. *Kelite Corp.*

38—Chain lubrication. Specific methods of chain oiling, from manual brush-type lubricators to completely automatic systems, are presented in Bulletin No. 1800 (8 pages). Illustrates applications, installations. *Oil-Rite Corp.*

39—Incinerators. Operating features of incinerators for small and large plants are given in illustrated 6-pager. Describes portable FG4-T series and standard stationary types, as well as wall unit. Photos. *Brulé Incinerators.*

40—Equipment care. Here's a 6-pager, "The Tools of Housekeeping," with tips to help plant custodians select, use, and care for such equipment as mops, buckets, vacuums, floor machines, and the like. *Puritan Chemical Co.*

41—Fire pump controllers. Booklet LJ-25 (8 pages) discusses company's new line of controllers approved by Underwriters' and Factory Mutual. Lists suggestions for the proper selection of protective equipment. *Cutler-Hammer, Inc.*

42—Fire guards. Bulletin B-10 (12 pages) describes and illustrates fire guards for flammable and combustible line protection. Devices include fire checks, backfire preventers, flame arresters, other products. *C. M. Kemp Mfg. Co.*

Turn the page

STEEL WAREHOUSE "TAKES TO THE AIR"

Fig. 1 — TRAK-RAK fork lift at top of column, lifting bundle of steel rod. Unit serves 3 long aisles of racks.

TRAK-RAK SYSTEM INCREASES STORAGE SPACE, SAVES 22% CAPITAL BUILDING INVESTMENT

When A. C. Leslie & Co. Limited, needed more storage area in its busy Toronto steel warehouse, it decided to "reach for the ceiling" with a Chicago Tramrail TRAK-RAK System of vertical storage and handling. As a result, the company estimates it not only saved 22% of projected capital building costs, but increased the overall efficiency and speed of the Toronto operation. The company expects to gain further economies as the TRAK-RAK system is used to its full extent.

A 5 ton capacity toprunning TRAK-RAK Crane was installed in each of two 40 ft. wide bays to serve specially designed 18 ft. high material storage racks (Fig. 1). Each crane bridge has an overhead trolley, from which is suspended an electrically operated rotating column

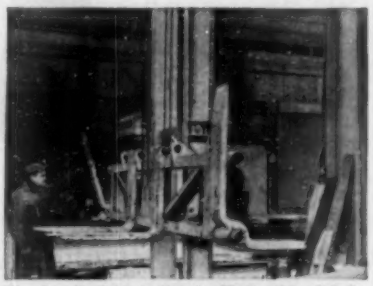

Fig. 2 — Carriage equipped with 2 pairs of forks. Operator is flopping outer forks up.

equipped with a special fork lift. All operations of the fork lift, which revolves to serve either side of the aisles, moves toward or away from the racks, and raises or lowers on the column, are controlled by the operator who rides with the carriage.

Two pairs of forks are mounted on the carriage. The outer forks may be flopped back (Fig. 2) leaving the inside forks in position for handling palletized or crated material. For handling long boxes, bars, etc., the outside forks are flipped back into working position.

A TRAK-RAK feature which added to handling speed and insured safe operation was the safety interlock switch system which prevents the column from running

Fig. 3 — TRAK-RAK column requires minimum aisle space for operation.

into a rack and permits full rotation only when the unit is safely beyond the end of the racks.

The A. C. Leslie Company reports that a similar TRAK-RAK System installed in its Montreal warehouse permitted a 37% savings in capital building investment with equally good operating efficiency and economy.

For complete details on the TRAK-RAK System of vertical storage and handling, write the manufacturer:

CHICAGO TRAMRAIL DIVISION

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Conco Engineering Works, Inc.

"I don't know who you are.

I don't know your company.

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Dept. F-12 DEMPSTER BROTHERS, Inc. Knoxville 17, Tenn.

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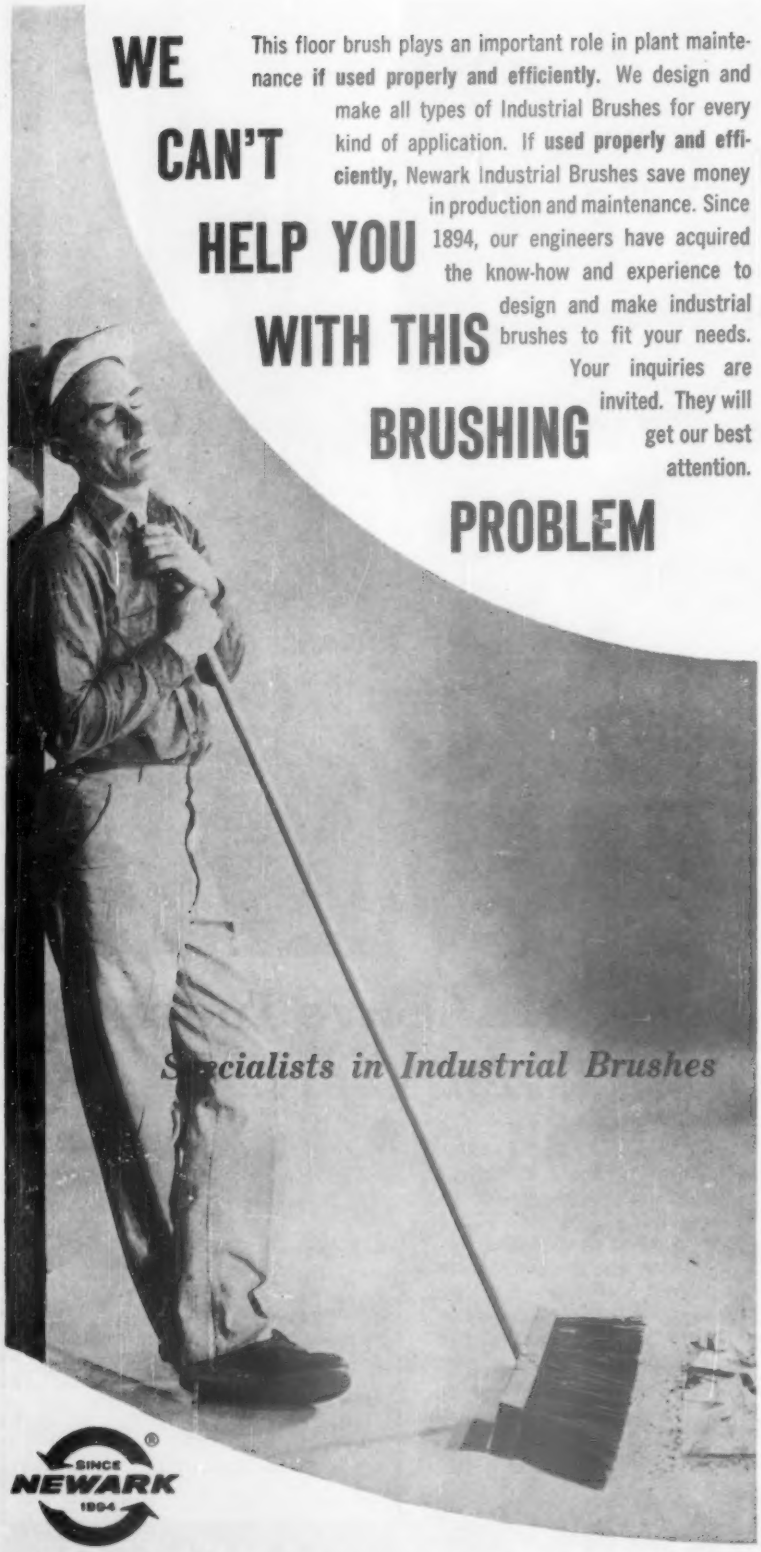
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CATALOG NEWS

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ELECTRICAL

43—Relay. Bulletin GPC-B49 (4 pages) explains difference between transistorized sensitive and conventional magnetic relays. Tells where to use transistorized relays. Lists specifications, connections, etc. *General Electric Co.*

44—Switchgear. This 40-pager (No. 2800-2B) describes new 4.16- and 13.8-kv. circuit breakers and switchgear—the first in this rating developed for stored-energy closing. Details on construction, layouts. *I-T-E Circuit Breaker Co.*

45—High-temperature wires. Specifications, UL listings and ratings, dimensions, and other data are given in 58-page catalog. Products include magnet, Teflon-wrapped and extruded hook-up wire, cables, and the like. *Hitemp Wires Co.*

46—Transformers. All-new gas-filled sealed dry-type transformers are presented in Bulletin GEA-6790A (8 pages). Describes cutouts, switches, and terminal compartments; accessories; special features. Photos. *General Electric Co.*

LIGHTING

47—Lighting fixtures. Catalog S-62 (8 pages) shows weatherproof cast aluminum fixtures, floodlights, and luminaires. Describes wide selection of standard and custom designs for many applications. Photos. *Stonco Electric Products Co.*

48—Stand-by lights. Emergency lights that operate instantly and automatically when normal lighting current fails are described in 8-page catalog. Points out advantages of both dry and rechargeable power supplies. *Carpenter Mfg. Co.*

49—Area lighting. Two catalogs: No. GET-3100 (16 pages) discusses street, floodlighting luminaires, with road and area lighting applications;

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MACHINE TOOL DIVISION
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Begins on page 160

CATALOG NEWS

For more data, circle item numbers you want on Reader Service Card.

No. GEA-7223 (30 pages), an area lighting guide, has quick selector. *General Electric Co.*

50—Troffers. Technical and other information on new series of troffers is contained in 4-page brochure and three data sheets. For all basic ceiling systems; diagrams show fixture construction for each type. Photos. *Litecraft Mfg. Co.*

AUXILIARY

51—Water heating equipment. Catalog 1551B (16 pages) illustrates complete hot water line that includes circulators, valves, fittings, specialties, converters. Specifications, performance curves, other data. *Dunham-Bush, Inc.*

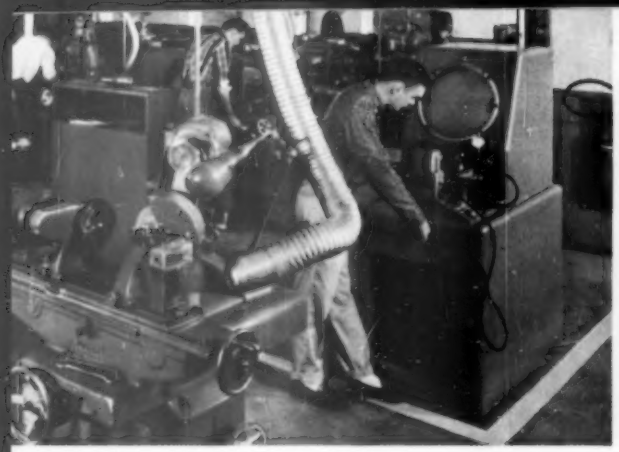
52—Boiler feedwater treatment. This 24-page booklet (No. 30) answers such questions as: How pure must feedwater be? How does operating pressure influence boiler water composition requirements? And many others. *Nalco Chemical Co.*

53—Fuel oil heaters. Bulletin No. 1416 has 12 pages of information on Twin G-Fin and Style B heaters. Includes sizes, tables of dimensions and capacities, diagrams of various heater arrangements. *The Griscom-Russell Co.*

54—Air handling troffer. Design flexibility, elimination of lamp color distortion and flickering lamps, increased ballast life, other details are discussed in Bulletin B. Three sizes; capacities to 200 cfm. *Thomas Industries, Inc.*

55—Infra-red heating. "Application of Panelbloc Infra-Red Heaters" is a 16-page manual that describes full heating jobs and spot heating. Contains seven tables, 11 graphs and drawings. *Bettcher Mfg. Corp.*

56—Waste treatment. Equipment and processes used in unit treatment are detailed in 16-pager (No. 3-SIC-



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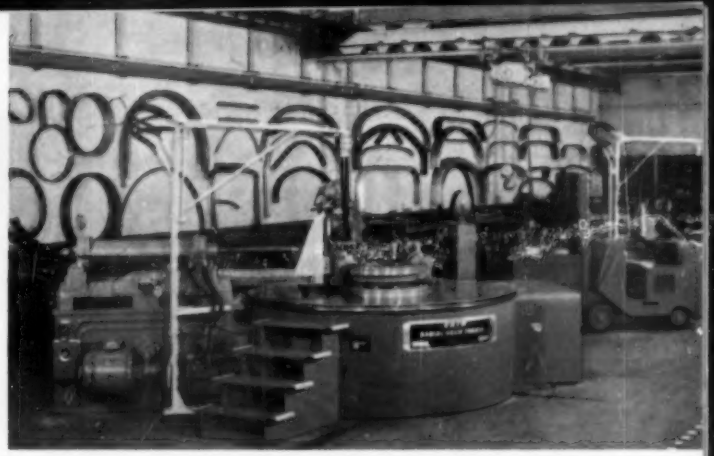
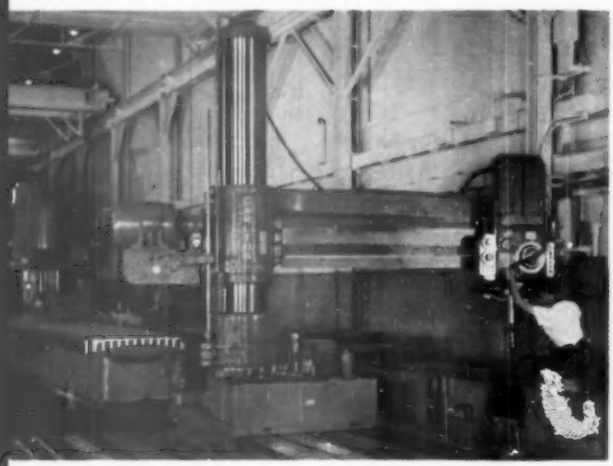


"The clean, well-ordered look COLOR DYNAMICS *has given our plant is visual evidence of our skilled workmanship." F. J. Phillips, sales manager, The Cyril Bath Company, Solon, Ohio.*



*"*COLOR DYNAMICS *helps us maintain the productive efficiency of our work force at higher levels for longer periods." W. R. Gerchow, vice-president, Buhr Machine Tool Company, Ann Arbor, Mich.*

*"*COLOR DYNAMICS *has given us for many years a desirable bonus in efficiency, morale and safety without extra cost." Clarence Davis, president, Davis Tool & Engineering Company, Detroit, Mich.*

Leading makers of specialized tools agree: Pittsburgh COLOR DYNAMICS® increases productive efficiency

- **Lessens eyestrain, physical fatigue**
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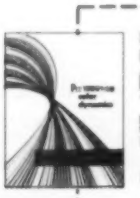

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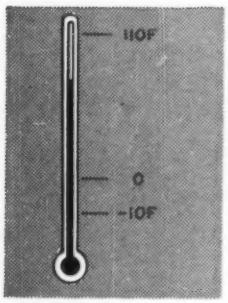
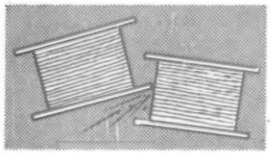
CABLE TALK

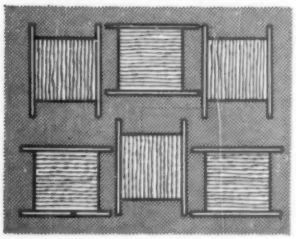
6 tips to help you make the most of your investment in wire and cable

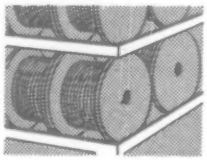


1. Avoid extreme temperatures –below 10F and above 110F (unless cable is specifically designed for this purpose). Low temperatures are seldom harmful to cable, but when they are combined with impact, flexing or other mechanical action, it's possible that the cable may be damaged by cracking, flaking or complete rupture of the coverings. Excessively high temperature, all by itself, can materially shorten the potential service life of stored cable. Thermoplastic components may soften and flow; rubber and many other materials undergo chemical and physical changes at high temperatures. You can avoid this problem by not storing cable near heating units, steam pipes, etc.

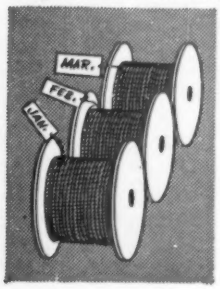
2. Avoid mechanical impact and crushing. Wire on a reel can be rendered useless by allowing the flange of another reel to crash against it. Arranging the stored reels in a crosshatch pattern is the simplest way to avoid this kind of accident. If space is at a premium, the reels may be stored in trays that allow only the flanges of adjacent reels to contact.



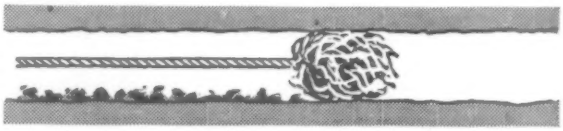




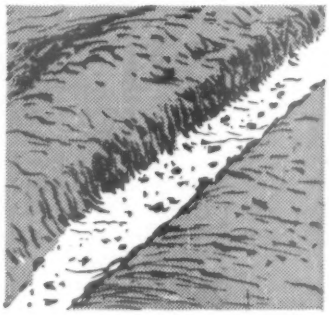
3. Use the oldest stocks first. Very few materials improve with age, so the sooner you use stored cable the longer it will last in service. Also, the less time a cable spends in storage, the less chance there is for damage. Keep rotating stocks so that the newest cable goes to the end of the line.



4. Swab conduit before pulling wire
A remarkable amount of abrasive material–nails, glass and such–can accumulate in conduit, pipe or duct before the wire is pulled through. And pulling a wire or cable through such litter could damage it severely. If you pull a swab through the conduit ahead of the wire to clear the way, you'll eliminate a big source of hidden installation damage.



5. "Direct burial" doesn't mean "on top of anything"
The specification "direct burial" on a cable doesn't mean that you can afford to bury the cable directly on top of whatever you might find in the earth. Trenches should be cleared of rocks and broken glass before the cable is buried. Freezing and thawing can make rocks shift position, and, possibly, exert enough pressure on the cable to cause premature failure. The same danger exists when wires that cross underground rest on each other. Moral: clear trenches before burying cable, bed the cable in sand, and keep crossed cables separated.



6. Pick the strongest component when pulling cable
When wire or cable is being pulled-in, either through conduit or aerially on poles, it's essential to put all the pulling tension on the strongest part of the cable assembly. Ordinary single-conductor material should have pulling tension applied to the bare conductor. Applying tension to the covering materials tends to stretch them, and can lead to breaks in some cases. Always pull preassembled aerial cables by the messenger, not by the insulated conductors. Interlocked-armor cable should never be pulled by the armor, since this may cause severe damage by unlocking the armor.

* * *

This collection of ideas comes from many years of probing into wire and cable problems–and solving them. It's likely that we've come across some problems just like yours, and together we could probably work out a fine solution. So, please give us a call, or write Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York. Department EFL-1-F 61304

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For more facts circle 495 on Reader Service Card

Begins on page 160

CATALOG NEWS

For more data, circle item numbers you want on Reader Service Card.

3900.21-1). Discusses waste treatment problems and ways of solving them, classification of wastes, etc. *B-I-F Industries.*

57—Heaters. This 20-pager (46S-46U46SE) contains specification data on three types of small-capacity steam and hot-water unit heaters. Capacities from 13,400 to 1,062,000 Btu.hr. Photos. *Carrier Air Conditioning Co.*

58—Steam heating specialties. Catalog No. 1501D (8 pages) gives capacities, dimensions, and weights of radiator valves, inverted bucket, high-pressure thermostatic, and other traps, gauges. Has 56 illustrations. *Dunham-Bush, Inc.*

INSTRUMENTS AND CONTROLS

59—Liquid level switches. Bulletin SF-765 (12 pages) describes switches that use ceramic magnets. Eight separate electrical circuits are possible from single instrument. In enclosure, float styles. *Robertshaw-Fulton Controls Co.*

60—Contactors, starters. Company tells about new 20-, 25-, and 75-amp. forms that have been added to its 30-, 40-, 50-, and 60-amp. devices. Bulletin GEA-7316A (12 pages) includes a selection guide. *General Electric Co.*

61—Tachometers. This 12-pager (No. 720) describes complete system including tachometer generators (transmitter), indicator (receiver), and connecting drives to machinery, motors, other rotating equipment. *Herman H. Sticht Co., Inc.*

62—Instrument counters. Specifications, detailed descriptions, and applications are given in 16-pager (No. 400). Counters are widely used as digital readout indicators in gauging instruments, business machines, etc. *Durant Mfg. Co.*

Cut your box inventory: Print fill-in data with this simple Pannier Package Printer

This customer manufactures nails and wire products. The line of cartons has just been printed on two sides to designate "8 penny box nails", using cartons with their standard company imprint. Thus they need no duplicate carton stocks to designate 6, 8, 10 penny box nails, nor a number of other sizes of other kinds of nails.

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This unit prints clear, solid and unsmudged legends in various lengths and number of lines required. Type sizes range from 1/16" to 2". Ink is supplied from a foam rubber cylinder to a transfer roll, which inks the type uniformly and without ink buildup.

Investigate this economical printer now! For complete information, write:

The Pannier Universal Package Printer head is a metal cylinder grooved to hold E-Z Set type characters or molded logotypes. You can get a varied number of type grooves. Taller cylinders are available on special order, but for more lines or height duplicate units installed in staggered positions are more economical.

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For more facts Circle 496 on Reader Service Card

Here were the all-too-familiar symptoms of a brutal profit squeeze: rising costs, diminishing productivity, increasingly tough foreign competition. Facing the problem head-on, a resourceful management team at Royal McBee's Hartford plant discovered the secret of...

MOD WIT

Late in the fall of 1959 a strange and unexpected tour "behind enemy lines" was arranged for the 3000 employees of Hartford's Royal McBee typewriter plant. As employees arrived for work one Monday morning, they were startled to find the company dining room filled with a display of the 40 different machines that spearhead McBee's competition. Outstanding among these were 35 high-quality models from Europe and Japan.

That morning educated hands unhooked side panels and craftsmen's eyes roved over escarpments, starwheels, and ribbon-drive gears. Brows furrowed in admiration and awe. But McBee was not trying to make its workers feel small. This was simply their latest move in a high pressure campaign to instruct their people in the perils and hazards of competitive business.

In November of the previous year McBee management began to hear the doleful refrain that has beset the ear of many a modern manufacturer: rising costs, diminishing productivity, increasing foreign competition. In fact, the profit margin at the Hartford plant was so small (only 0.4% of sales in 1958) that it barely broke even.

McBee management was faced with the familiar dilemma: If it took tough, effective measures to improve the situation for both itself and its workers, an over-suspicious union was likely to throw a monkey wrench into the works. And a long, debilitating strike was the last thing limping McBee could afford.

McBee's management pondered the problem, finally came up with a plan that was as simple as it was unorthodox. Tell the McBee employees the clear truth. Alert them, in ways they readily understood, to the necessities and challenges of modernization.

TURNING THE TIDE

Several corporations had attempted such communications programs before, but often with only marginal success. However, McBee's industrial relations department went into high gear, accepted the challenge head on. In a few weeks it had mapped a program so far-reaching in scope that it would have done credit to a campaign committee of professional politicians.

McBee's main concern was over spiraling labor costs—nearly 60% of the product's unit cost. And an intransigent local union leader was expected to press new wage and cost-of-living demands that would increase this burden yet further. If McBee could persuade its employees that prices should be stabilized and the cost-of-living clause temporarily removed from the agreement, then it would have turned the tide in the battle to survive.

One of McBee's first moves was to mobilize public opinion (and indirectly the opinions of its employees) in the Hartford area. Releases went out to radio and TV. Local newspapers were apprised of the economic effects of a possible closing of the Hartford plant. Withdrawal of the $21-million annual pay check could hold serious consequences for the continued prosperity of the Hartford community.

And McBee did not neglect the personal touch. Employees, in groups of 300, were briefed on the financial situation by a company vice-president. Foremen and supervisors were told how to handle questions and worries. Each was given fact sheets and a printed folder explaining the company's predicament. This often contained confidential information, such as the expenditures necessary to cover the cost of wages and fringe benefits.

LISTENING POSTS

Foremen and supervisors were instructed to act as "listening posts" to assess the developing reaction of their employees. Then management telephoned the plant's 55 foremen every morning and asked each one what his people were discussing and what seemed to be the prevailing climate in his department.

In addition to this personal attention, individual letters were sent by management to the homes of employees, describing their part in the operation and what they must do if

ERNIZATION HOUT TEARS

Or how a skillful communications program can help put an ailing plant back on its industrial feet.

the plant were to preserve its financial integrity.

However, the most lively aspect of management's grass-roots education program was expounded in pamphlets and in the monthly employee publication, *The Royal McBee News*. All 16 pages of the January 1959 issue were used to explain where the company stood.

Scattered between notices of new staff appointments and an article commemorating McBee's four-millionth typewriter, were items with more ominous overtones.

"Three Million in Wage Extras" chided one headline, while another warned its readers that "Utilities Cost Half a Million." At the bottom of the page Vice President A. S. Cook announced that the company spent over $3-million each year on maintenance and equipment. Close to this "small-arms fire" in the campaign to make workers cost-conscious thundered the banner head of the *News*' main feature. This item sternly advised the local city council not to go through with its intended four-mill property tax increase. "This could increase the company operating costs $40,000 a year," editorialized the *News*. "When increases of this nature take place, savings must be affected in other operating areas in order to keep the product price down."

In the months that followed, McBee unfolded a carefully planned campaign to enlist the support of workers at the grass-roots level. The union contract came up for renewal in January of 1960. McBee intended to educate employees to the economic facts of life before the union could formulate a new set of financially crippling demands.

The *News* ran editorials on the theme: "If you think the tax bite has got you, put yourself in the place of a corporation." This was followed by a budget breakdown on how Royal McBee distributed its $1¼-million taxes. Other articles hammered away with such slogans as "A fair day's pay for a fair day's work" and "A dollar saved equals $20 in typewriter sales."

MODERNIZE OR DIE

But McBee management did not make the mistake of talking down to its workers. The June issue carried a banner-line article entitled, "The European Market: What it means to You." The article that followed was a model of detailed clarity. Production-line workers read of the "flight of American capital abroad" and how a new set of tariffs was nurturing the sleeping giant of the European economy.

The news of a possible layoff in the McBee work force was explained as rationally and as gently as possible. "The course of history has shown that there is no gain without loss," explained one editorial. "In these cases the good of the majority must take precedence over the welfare of the few."

Stern words for a man about to lose his job. On the other hand, McBee's management was squarely facing up to the challenge that confronts almost every long-established plant: Modernize or die.

Month after month the *News* maintained its "wake up and live" barrage at full power. It discussed the life of a skilled Dutch worker in McBee's Leiden (Holland) assembly plant, and how he budgeted for his wife and six children on $23.80 a week. Another point stressed was absenteeism, costing the company an estimated $200,000 annually.

By midsummer 1959, the company's economic situation showed little improvement and it was necessary to lay off 200 workers. However, employees by this time had been so thoroughly briefed on the company's problems that the blame was not put upon management's shoulders. The program had borne its first fruit: A strike was averted.

McBee knew that it could not afford to relax, and the campaign continued at full pressure. Stress was laid time and again on the fact that competing European workers received only 50 cents an hour, in contrast to the $2.19 of the Hartford workers. The company also emphasized the importance of its annual $3-million worth of insurance and other fringe benefits.

Turn the page

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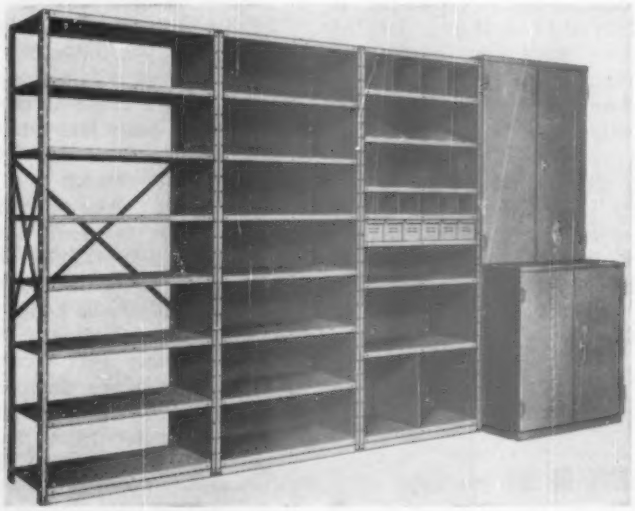

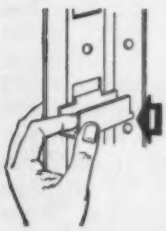

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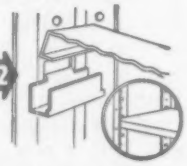

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. . . MODERNIZATION
Begins on page 174

In January 1960 management signed a new agreement with the union. This was the moment of truth for the McBee communications program. But management need not have worried. For a two-stage 11¢ increase in wages, the union agreed to drop the cost-of-living clause from the new agreement. As the ink dried on the new contract, McBee's industrial relations department could congratulate itself on successfully completing yet another phase of its economic education program.

Contrary to predictions, 1960 was no boom year for the economy in general, and Royal McBee felt the pinch even harder than most. Federal appeals for protective tariffs were rejected and inroads of foreign imports deepened. The union, Local 937 of the United Auto Workers, and management joined forces in asking state and federal agencies to levy these tariffs. The union even attempted to get the state industrial tax structure revised.

THE BIG DECISION

When all else failed, management in the spring of 1960, was faced with three alternatives: consolidate operations by moving all Hartford production to the new Springfield facilities; move production to a plant in Holland; or modernize the Hartford plant.

In July 1960, the decision was made to spend a million dollars to modernize the old plant. (See FACTORY, March 1961, page 90.) This way there would be no wholesale layoff of employees, as with the other alternatives. But there would be relocation of departments, consolidation of jobs, and job re-studies due to new machines and corresponding changes in procedure.

Management immediately realized the vital importance of selling employees on modernization. Change of any kind causes disruptions, and a major organization of equipment and processing could easily throw the whole plant into chaos.

McBee felt its communications program came through its initial trials with flying colors. Could not efforts be redirected and intensified to help the total revamp through

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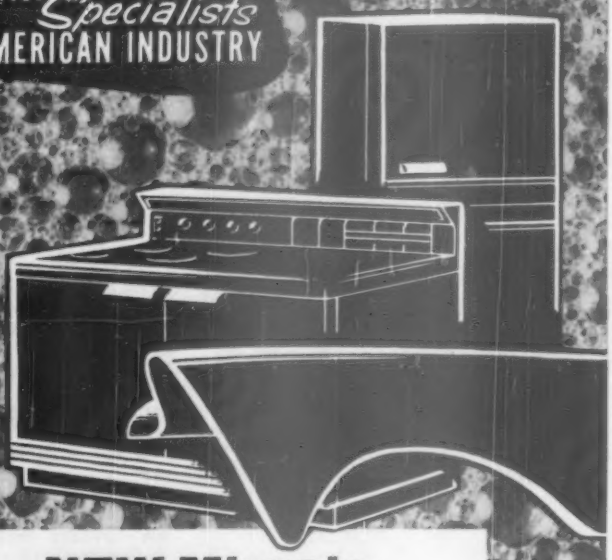

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Industrial Washers

Begins on page 174

smoothly? Soon the industrial relations department presented management with a geared-up communications campaign to explain the new modernization moves.

Opening in September 1960, the campaign attacked the problems of employee resentments and opposition to change with renewed vigor.

A combination of group and individual meetings kept workers up to date on progress and plans. Foremen and supervisors attended formal training seminars and briefings on changes in their departments.

Employees were exposed to a steady, but even flow of new developments. Bulletin boards carried special flyers and posters. A brisk, two-color brochure distributed to each employee gave a once-over-lightly explanation of the entire project. Wall charts in the "briefing room" indicated floor layouts before and after. Colored overlays showed completion of each move as it was made. Employee groups received guided tours to newly assigned areas prior to moving.

ONLY TEN BEEFS

Shortly before moving, each employee had a pow-wow with his foreman and a member of the industrial relations department. Those against moving could sometimes choose to remain where they were. But they had to compete for available jobs, if any, in the incoming department on the basis of seniority. The interview wound up with a formal introduction to the new foreman.

Supplementing this, each employee received a letter at home, signed by his old foreman. It again introduced the new foreman and leadman, stated working hours, coffee breaks and lunch hour, location of washrooms, fire exits, etc.

For many months the *News* plugged away on the progress of the renovation. Piece by piece and floor by floor, the changes got top display space. In every issue, the economic education continued.

Is all this saturation worth the trouble? The answer that feeds back is "yes." Even at this stage, with the modernization not yet complete, the results are measurable. So far, only

For more facts Circle 501 on Reader Service Card

Richard Branch, superintendent at Red Rock Quarry, Nesquehoning, Pa.

"Since installation in July, 1960 . . .

Constant, Heavy Impact Hasn't Stopped Our General Electric Polydyne® Drive"

"Since we installed a General Electric Polydyne mechanical adjustable-speed drive on our Universal Wobbler Feeder, we haven't had a moment's downtime due to malfunction since July, 1960," says Richard Branch, superintendent at Red Rock Quarry, Nesquehoning, Pa.

The wobbler's elliptical bars convey large rocks to a crusher and let fines and dirt drop through to another conveyor. The rock is unusually hard sandstone, which stratifies into large, thin pieces. This type of material creates a tremendous strain on the drive unit during initial impact and separation.

"THE FORMER DRIVE cost us $2,939 in maintenance and eight days' lost production during the year and a half we used it," continues Mr. Branch. "General Electric's Polydyne Drive is 15 horsepower, same capacity as the old one, but it's physically larger and much stronger. It has proved itself an excellent solution for our tough operating conditions."

When your application requires low-cost adjustable speed, reliability, and ease of maintenance, investigate General Electric Polydyne Drives. Ask your G-E Sales Engineer or write for bulletin GEA-6806, Section 854–07, General Electric Co., Schenectady 5, N. Y.

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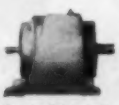

Footed Speed Reducer

Shaft-mounted Speed Reducer

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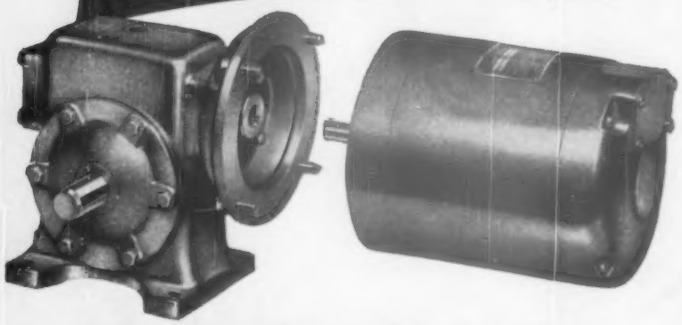

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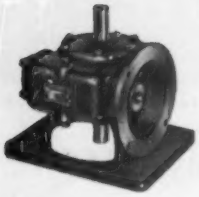
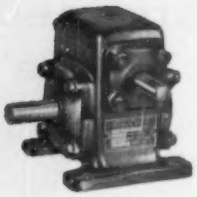
Worm Gear
SPEED REDUCERS



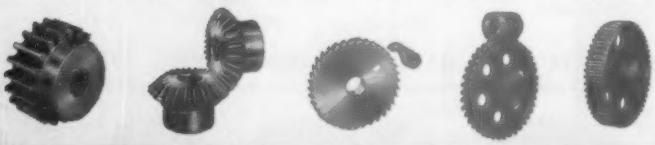


One of our major capabilities is to design, develop and produce speed reducers that will insure maximum performance and economy in your operation. Our experience in the special problems and objectives of power transmission is broad and deep. The men at American Stock Gear having this important capability, use the most advanced analytical engineering facilities to design speed reducers to meet tomorrows needs.

Whatever size or style reducer you need, you'll find the right combination in the complete Perfection line – a line that is precision engineered and performance tested in thousands of different applications.

If you have a reducer problem that you feel is "different", our engineers are ready to advise, design and produce speed reducers to your particular requirements. In the meantime, write for your copy of our Reducer catalog containing illustrations, charts and tables to help you on your next application.

We make a complete line of stock gears. Send for Gear catalog No. 360.



AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY, HARVEY, ILLINOIS

Begins on page 174

10 grievances have been charged directly to the modernization move. Workers seem to be accepting these changes with only minimum scattered resistance.

UNITED FRONT

We tapped a few workers on the back to get their opinions. Some complained of the confusion created by the moves. Others weren't quite sure why their departments had to move. But one thing everyone understood: the menace of rising costs and increased foreign competition. Some typical comments were:

On modernization: "We'll be better off with new lights, more room, and more conveyors. There won't be a pile-up of goods on the floor. It'll be a nicer place to work."

On communications program: "I think management is sincere. We all know the conditions; it's good to learn what's behind them, what management is trying to do."

On foreign imports: "I don't believe management is exaggerating the competition. This is really serious and we need a tariff to protect the industry."

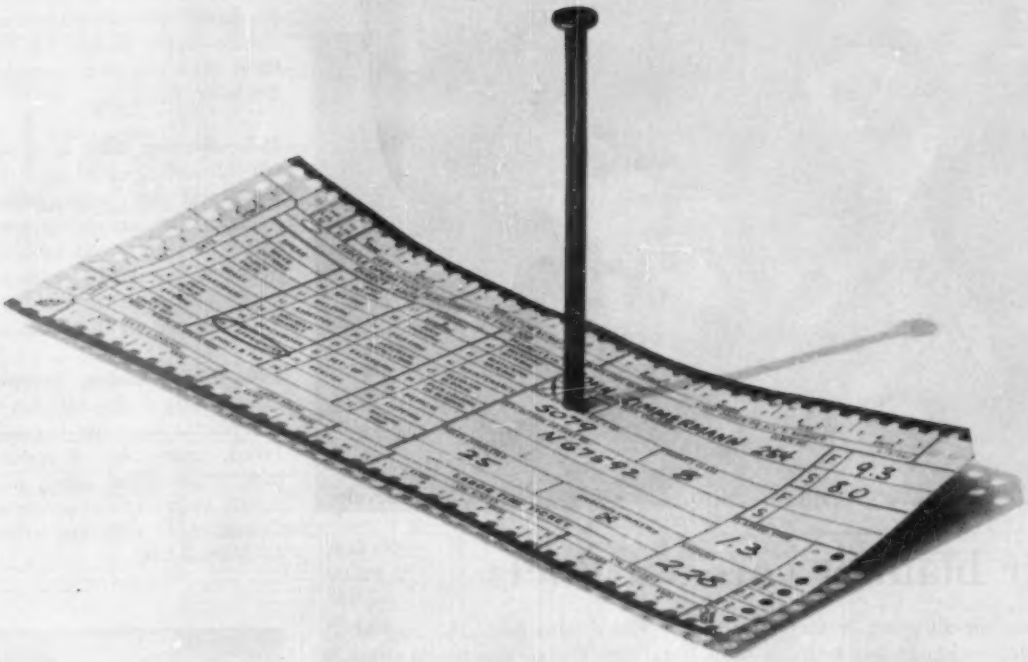
A union steward: "I think this is a very good program because it wakes up a lot of people. We can compare ourselves to others and learn about costs and so on."

From a foreman on modernization: "Morale is higher and people like to have a light, clean place to work. I've had very little trouble, because when my steward has a problem, he comes right in and we talk about it. Almost everything can be solved right here."

The skeptics might say that all this sounds fine, but where does the union fit into this happy harmony? We talked with the union business agent—who has become really wound up over the problem of foreign competition. In fact, his union has been beating the drums right along with Royal McBee. "We wrote to Congress and to the newspapers asking for help for the industry," confided the business agent.

This united front in the face of a common threat is convincing evidence of a communications job well done. **END**

NAILED!



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For more facts Circle 504 on Reader Service Card

MATERIALS NEWS

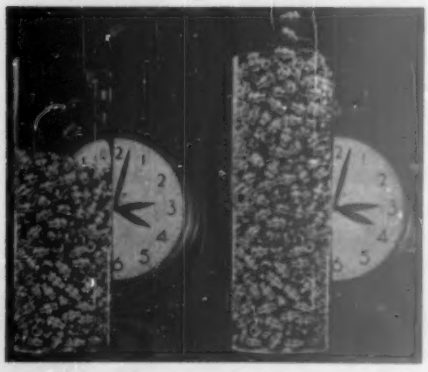
For more data, circle item numbers on Reader Service Card next to back cover.

Air blanket cuts out ducts

A new air-diffusion system for industrial buildings has been devised by converting acoustical ceilings into perforated vents. Photo shows how conditioned air is allowed to flow, at uniform velocity and pressure, through thousands of tiny perforations in the ceiling material. Drafts and stagnant spots are avoided because the air descends slowly on all parts of the room in a continuous uniform "blanket."

The system saves the cost of installing diffusers that would normally be placed in the ceiling. It also eliminates elaborate ductwork since a single stub duct is all that is required to deliver the air to plenum space above the ceiling. Each panel is incombustible and has high sound absorption. Also, the continuous down pressure of air keeps out dust and dirt. *Armstrong Cork Co.* (Circle 195)

Easy-cutting steel contains tellurium

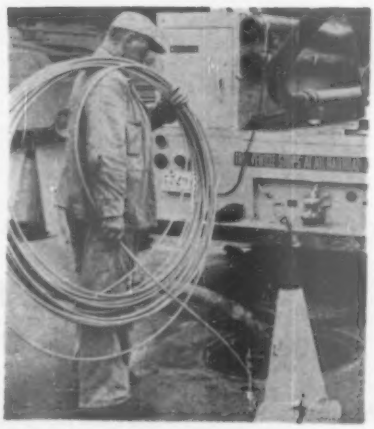


Machining speeds over 3½ times as fast as standard screw-machine steel are reported in recent tests with a tellurium bearing steel. Speeds of over 600 sfm. have been reached on extensive runs. The alloying element acts as a built-in lubricant, producing small chips in the cutting process. These chips fall away from the cutting tool, thus reducing high-temperature build-up. *La Salle Steel Co.* (Circle 196)

197—Nickel alloy can be deposited without electricity on plastics, glass, rubber, and many other non-conductors. The nickel-phosphorous alloy is more corrosion-resistant than electro-plated nickel, provides uniform thickness over complex parts. *Enthone, Inc.*

198—Bearing alloy is designed for self-lubricating bushings, bearings, seals, and other applications where strength and durability are important. This high-lead bronze is produced in standard lengths of 13 in. and up to 5 in. in dia. *American Smelting and Refining Co.*

199—Color coding compound to identify size or formulation of metal and plastic materials is packaged in 16-oz. spray can. A special alkyd base allows the color to adhere tightly on grimy and greasy surfaces. Comes in 11 different colors. *Perc. E. Harms Co.*

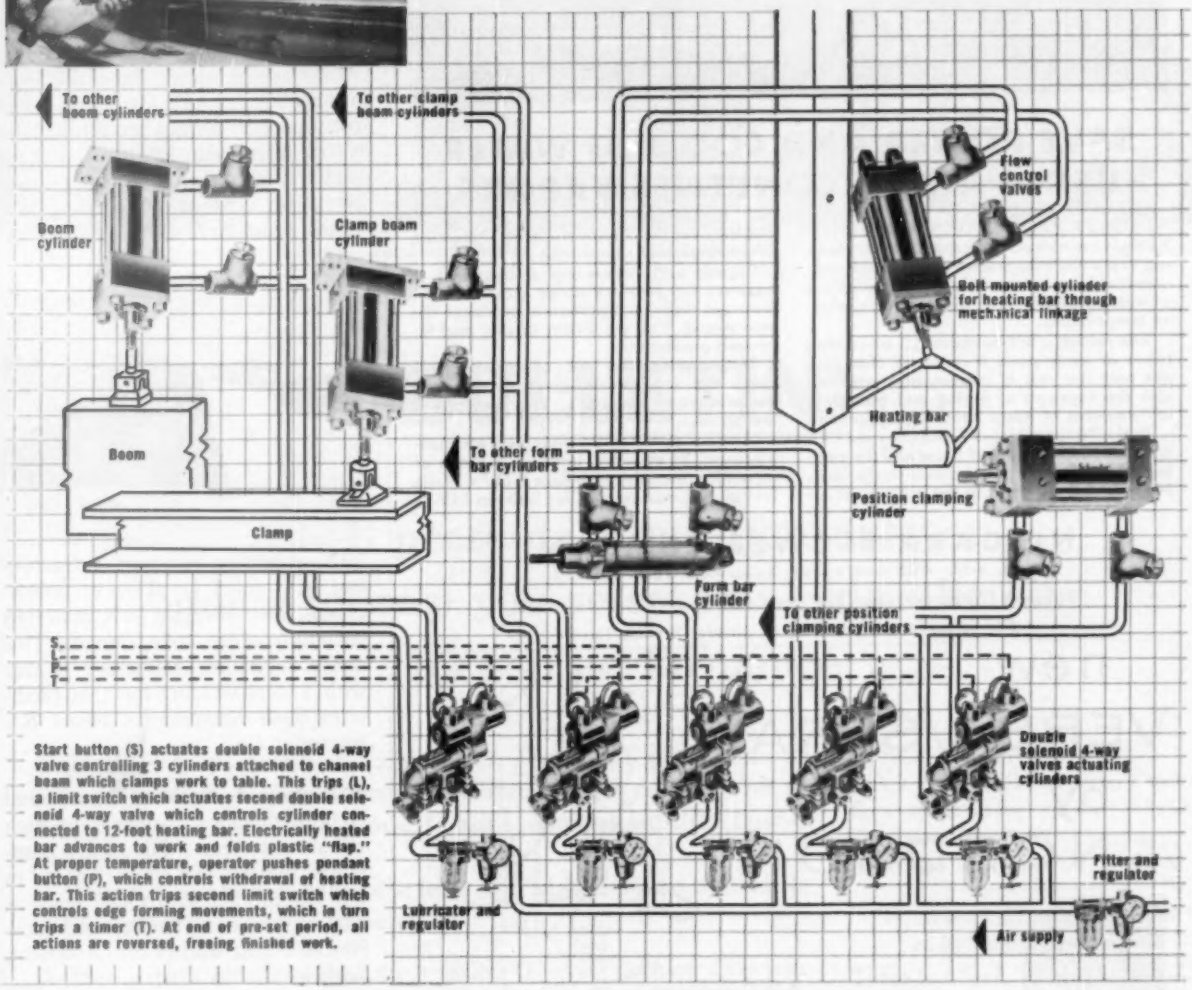


Plastic fishtapes

A revolutionary new fishtape combines absolute non-conductivity with strength and stiffness of conventional steel tapes. The plastic tape weighs less than one-fifth of steel tape, can be carried easily by one man. Its smooth surface takes it through packed raceways with little effort. *Cadillac Plastic & Chemical Co.* (Circle 200)

Turn the page

There are over five dozen Schrader products in this super-productive machine! Table tops and plastic positioned and clamped, a heating bar prepares the edges for forming, and bend is made. A new top is finished every 150 seconds! George Pardonnet of Detroit's Pardonnet Manufacturing Co., who built the machine for Plastic Tops, Inc., a neighboring company in which he also has an interest, says: "Schrader Air Controls fit the application better than anything else would."



Start button (S) actuates double solenoid 4-way valve controlling 3 cylinders attached to channel beam which clamps work to table. This trips (L), a limit switch which actuates second double solenoid 4-way valve which controls cylinder connected to 12-foot heating bar. Electrically heated bar advances to work and folds plastic "flap." At proper temperature, operator pushes pendant button (P), which controls withdrawal of heating bar. This action trips second limit switch which controls edge forming movements, which in turn trips a timer (T). At end of pre-set period, all actions are reversed, freeing finished work.

ZIP! A COMPLEX FORMING OPERATION IS FINISHED IN 2½ MINUTES...WITH AIR

Selected Schrader Air Products—combined in a custom built machine—are forming plastic counter tops to precise specifications at this company. Problems of temperature, pressure, timing, dimension, and speed are all solved perfectly in a streamlined sequence of air control. And it's all automatic! Fantastic? Perhaps, but there's practically nothing you can't accomplish more efficiently by combining Schrader Air Products in planned air circuitry. Schrader's full lines of air cylinders, valves and accessories have the quality, stamina, and engineering simplicity you need. Follow this manufacturer's example and utilize the air you already have more fully, the Schrader way.

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QUALITY AIR CONTROL PRODUCTS

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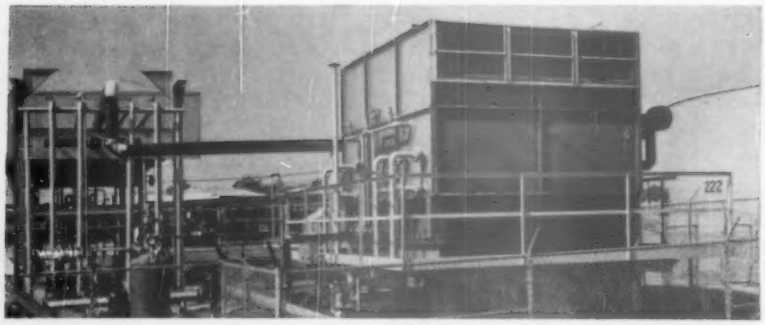

SAVE POWER AND COOLING WATER USING AIR TO CONDENSE VAPORS

NIAGARA *AERO*® VAPOR CONDENSERS give sustained full capacity in condensing vapors by evaporative cooling with only nominal use of water. You have no problem of water availability, or disposal, or quality, or temperature.

The system is self-contained... no cooling tower or spray pond is required. You save not only the cost of condensing water but also the expenses of piping and pumping, and the cost of water handling equipment.

In the Niagara Vapor Condenser the heat is removed at the rate of input and the cooling effect, directly proportional to the load, is controlled by varying the amount of air passing over the cooling surfaces. Operation is automatic and trustworthy.

Liquids and vapors are always held at constant temperature under close control. You get uniform distillation products the year round. You get better quality and increased production.

Non-condensibles are effectively separated and sub-cooled, giving you better vacuum pump operation. You save power and steam.

Niagara *Aero* Vapor Condensers are manufactured in standard units in a range of capacities up to thirty million BTU's. Write for full information; ask for Bulletin 139-R.

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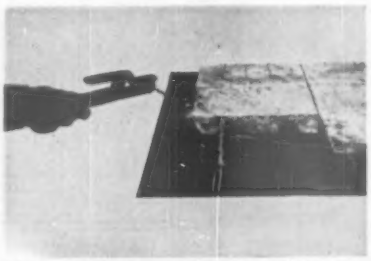
Begins on page 182

MATERIALS NEWS

For more data, circle item numbers you want on Reader Service Card.

201—Lubricants are now being marketed in spray cans for easy application to fork-lift trucks. The four specially formulated oils include a fork-lift upright lubricant, a chain and cable lubricant, a battery preservative, and a penetrating oil. *Clark Equipment Co.*



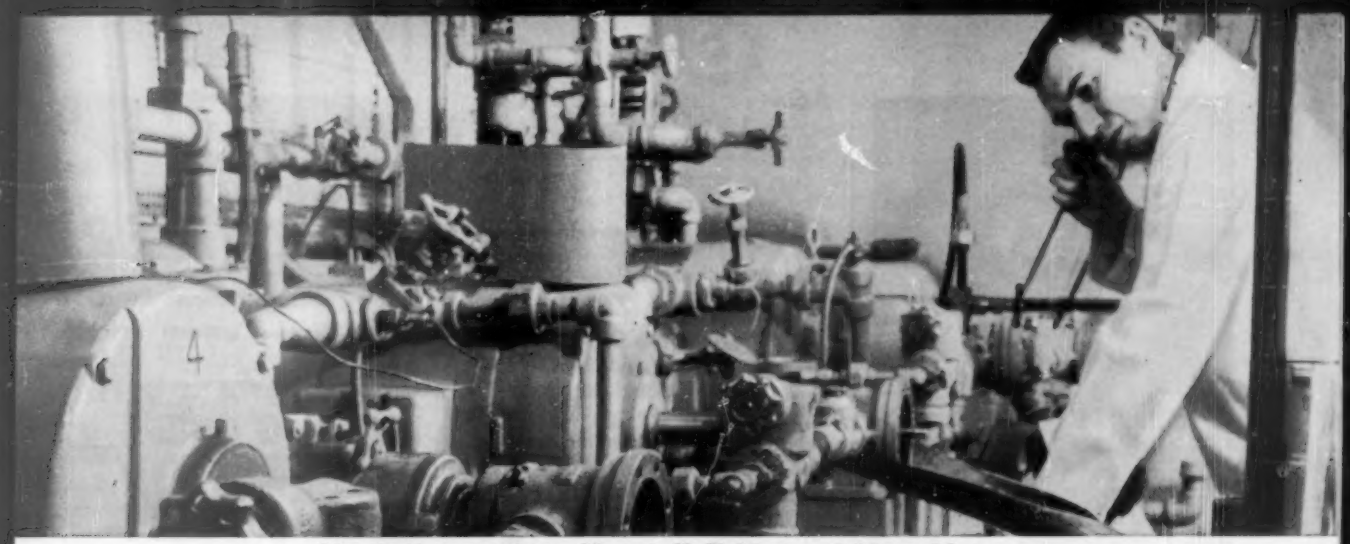
202—Abrasion-resistant refractory can be welded in place to protect chutes from abrasive bulk materials such as iron ore, coke, cement. This dense crystalline refractory is cast with a steel welding lug that facilitates flush-mounting. *Corhart Refractories Co.*

203—Liquid locking compound secures threaded fasteners in high vibration systems. The plastic compound remains wet while exposed to air, but contact with metal (a catalyst) causes it to harden and lock. Has indefinite storage life. *American Sealants Co.*

204—Rubber gasket sealers permit positive sealing of uneven or tapered joints and right-angle bending without cutting and fitting. Unusual cross-section design enables sealer to perform as a rubbery gasket when pressed into a seam. *Minnesota Mining and Mfg. Co.*

205—High-temperature lubricant, tungsten disulfide, is now being marketed in commercial quantities. Can be used in solid-film form or as an additive to carriers to lubricate wire drawing, metal cutting and valves, gears and bearings. *Sylvania Electric Products Inc.*

Turn the page



Listening for pump chatter. Here—in Shell's Martinez, California, laboratory Shell Tellus hydraulic oils are subjected to the most demanding tests.

BULLETIN:

Shell presents a question-answer guide to help you select the hydraulic oils for top performance

Selecting the proper hydraulic fluid for your equipment can be one of your most important decisions. And it can pay off in many ways. Less down-time. Longer equipment life. Lower cost per unit.

Here are six bench marks to help you pick the best hydraulic oil for your plant requirements.

1. Does it have good oxidation stability? Oxidized hydraulic oil can form gums, lacquers and other deposits which may foul moving parts. Shell Tellus Oils are carefully refined to remove unstable, sludge-forming components—then fortified with a Shell-developed oxidation inhibitor.

2. Will it resist foaming and emulsification? Pump chatter and erratic operation are often the result of pump cavitation, brought on by oil foaming. Tellus® Oils contain additives to help prevent foaming.

3. Does it fight rust and corrosion? It is difficult to exclude all moisture from a hydraulic system. And moisture can form troublesome rust. Shell Tellus Oils have been carefully compounded to resist corrosion.

4. What are its lubrication qualities in continuous service? Shell Tellus Oils form a clinging, oily film on mating metal surfaces. This maintains a constant guard against wear.

5. How does it react to temperature changes? This is a key factor in the performance of hydraulic equipment. Careful selection of the proper viscosity grade of Tellus assures satisfactory operation of your system over its entire temperature range.

6. Is it available in several viscosity grades? Shell Tellus Oils are available in a broad range of viscosity grades. There's a special grade for virtually every hydraulic requirement.

Ask your Shell Industrial Products Representative for facts on Tellus Oils. Or write: Shell Oil Company, 50 West 50th St., New York 20, N. Y.

A message to manufacturers of hydraulic equipment

There is a Shell Tellus Oil suited for your equipment.

1. Your customers can get Tellus Oils at Shell depots everywhere. Readily available throughout the world.

2. Quality is consistently high. Tellus always delivers top performance.

SHELL

A BULLETIN FROM SHELL
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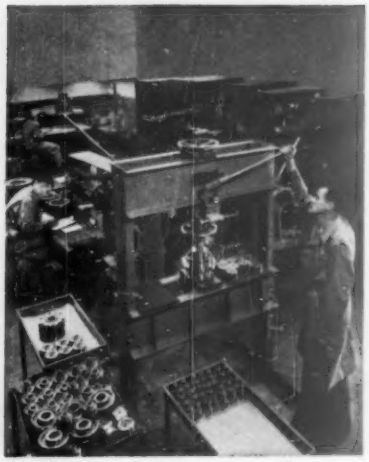

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Precision Power Transmission Products

186 **Circle 509 on Reader Service Card**

Begins on page 182

MATERIALS NEWS

For more data, circle item numbers you want on Reader Service Card.

206—Work clothes have a high resistance to strong acids and caustics. This polypropylene fabric resists sulfuric acid in strengths up to 94% concentration without loss of tenacity. It is strong, lightweight, quick-drying, comfortable to wear. *Worklon, Inc.*

207—Power transmission belting incorporates static dissipating properties that eliminate the possibility of sparking explosive atmospheres. Also has application in food processing plants where atmospheres are often filled with combustible dusts. *Extremultus, Inc.*

208—Building panels of vinyl provide a lightweight and versatile material for walling and roofing industrial plants and warehouses. The panels are flexible yet can support a uniform load of over 100 lb. per sq.ft. They resist frost and rot. *Allied Chemical Corp.*

209—Anti-corrosion tablets dropped into a humidifier's water reservoir stop scale formation, algae and other clogging impurities. Dosage varies according to water hardness. Good for wick-type, electric, and atomizing humidifiers. *Stewart-Hall Chemical Corp.*

210—Wall adhesive is for mounting junction boxes to plant's masonry walls, tiles, ceilings, floors, metal beams, and wood surfaces. It eliminates the need for drilling, bolts and plugs. From eight to ten boxes can be firmly mounted in less than 15 minutes. *Permacel.*

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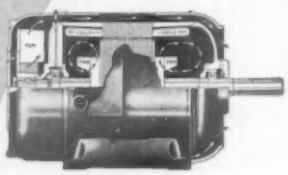

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FACTORY

Begins on page 182

MATERIALS NEWS

For more data, circle item numbers you want on Reader Service Card.

MATERIALS LITERATURE

211—Engineered maintenance materials made of polyester, epoxy resins, and glass fiber are described in 44-page loose-leaf booklet. Products include plant floor surfacing, patching, and tank linings. *Fibre Glass-Evercoat Co.*

212—Filters of Polypore membrane are discussed in this 24 pager. Applications include air sampling and cleaning, tracer studies, food and beverage filtering, precision manufacturing, and ultrasonic cleaning. *Gelman Instrument Co.*

213—Thermal insulation by silicone rubber at temperatures up to 9000 F. is the subject of 4-page CDS-299. New research shows that the hard carbon layer formed at high temperature protects underlying surfaces. *General Electric Co.*

214—Solid lubricants are discussed in an 8-pager (No. 132). Includes lubrication problems such as galling and seizing, extreme pressures, high friction, chemical reaction, and lubrication at extreme temperatures. *Alpha-Molykote Corp.*

215—Grease problems of all kinds are analyzed and resolved in comprehensive 32-page bulletin. It covers, in simple concise terms, the basic principles, properties, and rules for the application of grease. *Bardahl Mfg. Corp.*

216—Sound control by means of cellular glass acoustical units is described in new 12-pager (GC-5). Contains tables of sound absorption levels for offices, cafeterias. *Pittsburgh Corning Corp.*

217—High alloy castings are dealt with in useful 20-pager (No. G-261). Lists ACI nomenclature, metallurgical properties of some 55 different alloys for industry, other data. *The Duraloy Co.*

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Prime-Mover Pallet Trucks represent the latest engineering design—most efficient production techniques—strongest modern materials. Fewer and stronger parts mean longer, trouble-free, dependable service and performance.

The sealed hydraulic system is precision machined with ground finishes to maintain positive, leak-proof operations. All wear points are cast and machined rather than formed or stamped. Up-dated and made to traditional PRIME-MOVER high standards.

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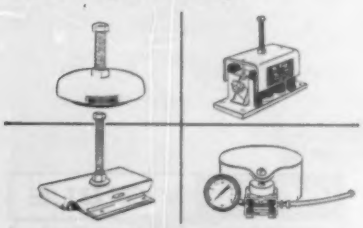
WITHOUT A CUSHION?

The longer you sat on it . . . the more you wished you had a cushion, didn't you? And remember how you felt every little vibration from those passing trucks?

Precision manufacturing equipment feels vibration too, but it can't get up and move away very easily — particularly when it's lagged down to a concrete foundation! Machine tools simply show their discomfort by higher reject rates or continuous maintenance problems.

What's the answer?..SERVA-LEVL® Mounts . . . a new concept that floats precision machinery on columns of air! Even ultra-precision, numerically controlled machines no longer require special, *costly* foundations. And, SERVA-LEVL Mounts *automatically* keep your machine *absolutely level* . . . as precise as 50 millionths of an inch per foot under the shifting load conditions of a long-bedded lathe.

If your machine tools are bothered by vibration, or if you want layout flexibility, no-shim leveling, reduced maintenance, and cost reduction . . . write for your copy of Bulletin 60-04B, "Practical Considerations When Installing Machinery."



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188 Circle 513 on Reader Service Card

BOOKS

A Bible on nondestructive testing

(Note: In September, FACTORY *announced the availability of these two volumes. Since then, our engineering editors have examined the set further and have given it ringing praise. The following remarks are those of our production editor.)*

Engineering designs and manufacturing procedures are becoming more complex, and service loads and operating conditions increasingly severe. Destructive testing of a small percentage of products can no longer insure adequate product reliability in the field. For this reason, the proponents of nondestructive testing, the Society for Nondestructive Testing, have prepared a two-volume handbook on the subject for industrial and college use.

The text evaluates the need for both types of testing. However, it concludes that nondestructive testing is more capable of detecting flaws or defects that cause premature service failures. This is because it can test and evaluate up to 100% of the parts that actually go into service.

Edited by Robert C. McMaster, the handbook is an impressive presentation of the principles, policies, and techniques of nondestructive testing. It reflects the vast experience and judgment of 106 prominent scientific and engineering specialists in the field. It is the first large-scale, international effort to integrate this important engineering information into a single reference source.

Half of the text is devoted to new techniques, e.g., isotope radiography, eddy current, and ultrasonic immersion testing. These have greater sensitivity, accuracy, reliability, and abilities than older methods, and can provide information at a much lower cost. Results can be obtained during the production cycle, so material or process corrections can be made immediately. This opens up countless avenues for cost reduction —including maintenance cost reduction, which is treated at length in the two volumes.

Throughout the book, theories are well explained and illustrated with diagrams and photos. Test selection charts furnish excellent guidance on just which test methods to use for given types of materials and defects. Graphs and photographic enlargements show how to interpret and evaluate test results. Pointers tell how to detect and correct errors made in procedures. Methods for mechanizing and automating testing procedures are also included, thus rounding out the cost-conscious approach of this text.

The book goes beyond the normal handbook presentation in its scope and elaborateness. Even its comprehensive 97-page index is more than sufficient to locate specific items quickly in the 54 chapters.

The reader—engineer, plant manager, researcher—will find these volumes extremely valuable in updating his company's technology on quality evaluation and improvement. This handbook deserves a prominent place in every industrial library. (Reviewed by G. V. Schultz)

Nondestructive Testing Handbook, edited by Robert C. McMaster. Ronald Press Co., 15 East 26th St., New York 10. Two volumes, 1760 pages. $24.

Labor problems held up to a bright light

The cases examined here are worth study by anyone who works with a union. This is a handy, practical desk book of the "common law" of industrial labor relations. Based on an analysis of cases and awards of the American Arbitration Association, it covers such issues as the reduction of the work force, seniority and ability, call-in pay, overtime, discharge and discipline, and many others. Written by the author who prepares FACTORY's monthly feature, "You be the arbitrator." (Reviewed by L. R. Bittel)

Labor-Management Contracts at Work, by Morris Stone. Harper & Brothers, 49 East 33rd St., New York. 307 pages. $5.50.

Turn the page

This man...
is running this locomotive

There is no one in the locomotive. The man in the picture can speed up, slow down, stop or reverse this train, *whether he is riding the locomotive or walking, or standing on the ground.* Both he and the locomotive are equipped with a new Union Switch & Signal remote control system for industrial switching locomotives. Because the operator always can be at the best vantage point, blind operations are eliminated and cars are spotted for loading, unloading or dumping more efficiently. This man can put a car *precisely* where he wants it.

You can minimize the hazards involved as freight moves around your plant with this unique remote control system. If you have a special problem such as moving cars into a thawing pit or under a loading chute, use a centrally located console control unit so one man has complete control over the entire operation.

Look over your in-plant locomotive operation and see if it couldn't be made safer and more efficient if the man running the train could always see what he was doing. Check the coupon for our illustrated Bulletin 187 on how our remote control systems can work for you.

Union Switch & Signal
Division of Westinghouse Air Brake Co.
Pittsburgh 18, Pennsylvania

☐ Please send Bulletin 187 on Union Switch & Signal remote control systems.

☐ Please have representative call.

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UNION SWITCH & SIGNAL
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Begins on page 188

BOOKS

Help on training

Here's a sound, scholarly look at training in industry; a straightforward statement of management's interest in and responsibility for training. It's well documented with believable, useful cases. And it's written so as to be helpful to the non-specialist as well as the professional trainer. The book is a valuable addition to the limited number of training books on the market. (Reviewed by L. R. Bittel)

Training in Business and Industry, by William McGehee and Paul W. Thayer. John Wiley & Sons, Inc., 440 Park Ave. S., New York, 305 pages. $7.50.

* * *

Work Sampling for Modern Management demonstrates with sharp, clear thinking how the skilled use of work sampling can improve standards, increase labor productivity, and make higher earnings possible. Offering a step-by-step explanation of how sampling studies are made, it requires no previous training in statistics. Work sheets, charts, and tables are easy to use, and illustrations are taken directly from modern industrial operating situations. For those interested, the appendices contain an elaboration of the theory behind work sampling.

Work Sampling for Modern Management, by Bertrand L. Hansen. Prentice-Hall, Inc., Englewood Cliffs, N.J. 263 pages. $7.50.

The Defense Materials System and Priorities describes the defense materials system and how priorities and allocations are administered. This is particularly important for defense contractors, who should familiarize themselves with these regulations and orders to maximize their contributions to national security. The new booklet, replacing the previous pamphlet published in 1955, presents in non-technical language the manner in which defense contractors are required to operate.

The Defense Materials System and Priorities. U. S. Department of Commerce, Washington 25, D.C. 52 pages. 25 cents.

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New materials alone cannot produce a "new" plant–or good value. It takes new thinking, too. That's what you get in a Butler MRF building; a new concept that results in *uncluttered* spaciousness. Result, you get more long term production efficiency and economy.

Look at some of the features in the pictures above. Notice the spacious interior. Rigid frames are supported by slender steel posts. The system is so flexible, you build in modules of 40, 50, 60 or 80 feet. Bay lengths of 20, 24, 30 or 40 feet. Widths up to 360 feet.

Thanks to the rigid-frame construction, conventional, space-consuming web trusses are not needed. Butler's MRF design provides additional feet of valuable interior clearance for any given wall height, an important plus. Or you can reduce peripheral wall height – and costs – for a given clearance.

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Handsome building, too. You have your choice of three beautiful wall systems – two of them factory-insulated. All of them factory-finished in striking colors.

These are but a few of the features that make the Butler MRF building "new"... and a new high in value. For the full story, phone your Butler Builder. He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Ask about Butler's "Finance Formula for Progress," too. Or write direct.

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For more facts Circle 515 on Reader Service Card

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WE ARE

GETTING

SOMEWHERE!

Twenty-five years ago, only 1 in 7 cancer patients was being cured. Fourteen years ago, 1 in 4. Today, 1 in 3 is being saved.

With what science knows about cancer right now, *one in two* could be saved by means of earlier diagnosis and proper treatment. The tragic fact is, however, that this year more than 85,000 Americans – who might have been saved – will die from cancer!

To learn how to guard yourself against cancer . . . the importance of Cancer's Seven Danger Signals and other life-saving facts . . . call your nearest Unit of the American Cancer Society or write to "Cancer" in care of your local post office. More than a million Americans are alive and well today, cured of cancer, because they went to their doctors in time.

AMERICAN CANCER SOCIETY ®

FILMS

Communications Unlimited presents microwave as a versatile, reliable and economical means for multi-location businesses to relay vital information. Gives a basic explanation of microwave radio—what it is and what it does. Installation shots show equipment that carries high-speed data, voice messages, facsimile forms, etc. 16mm, sound, color, 22 min. Write to :

Motorola Communications and Electronics, Inc., 4501 West Augusta Blvd., Chicago 51.

Walls Without Welds reviews steel-making processes. The story follows the ingot step-by-step through the rolling mills, clearly showing the shaping, then the piercing of the solid billets—the heart of the seamless process. Animated sequences clarify the operations. 16 or 35mm, sound, color, 28 min. For loan, write to:

United States Steel Corp., 71 Broadway, New York 6.

Economize With Attachments shows how the versatility of lift trucks can be increased with special hydraulic attachments. The film highlights revolving clamps, slip-on arms, turn-a-fork, slide-shift, load push and pull, and other attachments in action. 16mm, sound, color, 15 min. Write to:

Allis-Chalmers Mfg. Co., Engine-Material Handling Div., Milwaukee 1, Wis.

Flammables Engineering demonstrates potential hazards in the mishandling of flammable liquids as well as correct techniques and methods of working with them. Presents ways of stimulating interest in and cooperating with the work of safety departments in setting up procedures. 16mm, sound, color, 26 min. For loan, write to:

The Protectoseal Co., 1920 S. Western Ave., Chicago 8.

See-Hear, Mr. Businessman is the 1962 catalog (70 pages) of business and industrial films, filmstrips, and slides available from source below. For a copy (20¢), write:

City College of New York, Audio-Visual Center, 17 Lexington Ave., New York 10.

Lewis

UNITIZED ASSEMBLY CONTAINERS

FOR
- ASSEMBLY
- PRODUCTION
- STORAGE

Lewis Plastibox containers are one-piece molded plastic. They are smooth, strong, non-corrosive, easily cleaned. Colors, either green or yellow, are molded-in. Plastibox containers stack securely and afford maximum storage of small parts. Sizes available are 8½" long x 5" wide x 4½" deep, 6" x 3½" x 2½", 3" x 3½" x 1¾", and 3" x 3½" x 1¾" with a vertical divider.

MOUNTING RAILS— Rails are supplied in 18" and 36" lengths to mount 4 or 8 of the 3 smaller size Plastibox containers; 3 or 6 of the largest size. Rails afford a wide variety of bench or wall arrangements for any assembly or storage operation.

MOBILE TRUCK ASSEMBLY — These Lewis trucks handle all sizes of Plastibox containers and allow the boxes to be quickly and easily moved from one area to another. Trucks furnished with 36" mounting rails, two swivel and two rigid casters, and are finished in grey enamel.

WRITE TODAY
for complete information and brochure

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Arno

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Here's protection by the roll for above-ground and buried pipe. Arno Pipe-Wrap is made of stretchy, inert polyethylene with a pressure-sensitive adhesive. Provides a tough, continuous barrier to protect pipes against rust, acid and alkalis. Reduces replacements . . . fast, easy to apply. Send for FREE test sample.

Manufacturers Agents Wanted For Some Selected Areas

Arno ADHESIVE TAPES, INC.
Dr. Scholl's Adhesive Tape Division
5211 Ohio Street, Michigan City, Indiana

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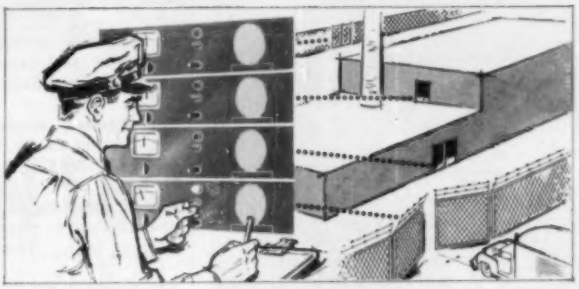
CUT PLANT PROTECTION OVERHEAD!

Now just one man, two wires, and Honeywell controls can tend your doors and gates



Stationed at a control panel, one centrally-located man or your telephone operator can control traffic at any door or gate safeguarded by Honeywell.

Located up to four miles away, *one man* . . .

- can determine the position of any door or gate and open or close it automatically.
- can determine the presence of anyone, at any time, and permit admittance of employees, authorized visitors and deliveries.
- can talk to anyone at a controlled entrance over a two-way communications system.

If positive, visual identification is required, closed-circuit TV can be added later.

Honeywell's door and gate control costs as little as $600. Many plants report that the system pays for itself in less than one year! For more detailed information on how you can save with Honeywell's door and gate control, call your nearest Honeywell office. Or send the coupon below. *Sales and service offices in all principal cities of the world.*

Honeywell

H HONEYWELL *First in Control* SINCE 1885

Door and gate controls are just one of Honeywell's practical and proven security and equipment monitoring systems. Others: central control panels, electronic fences, local annunciators, power supplies and systems for sonic motion and fire detection.

MINNEAPOLIS-HONEYWELL
Dept. FM-9-163, Minneapolis 8, Minnesota

Please rush information on your low-cost door and gate control.

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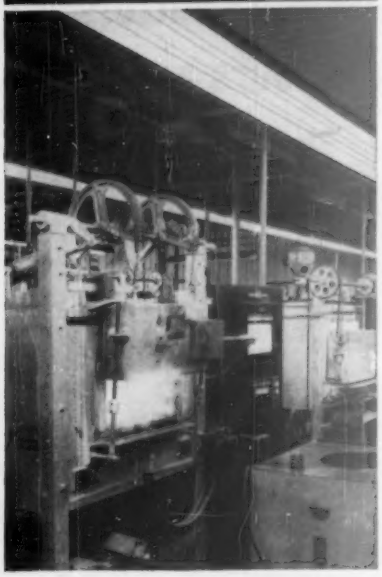
Hints on fluorescent starter selection



Where abnormally high temperatures or voltage drops exist— G-E FS-85NA or FS-4NA STARTERS ARE BEST

The automatic reset feature of these General Electric starters makes them ideal for use where unusual conditions of heat, or drops in line voltage, frequently cause accidental lock-out of fluorescent lamps.

They permit easy restarting of good lamps, while preventing blinking of burned-out lamps. Get G-E FS-85NA (two-terminal) or FS-85NA-4 (four-terminal) for 100W and 90W lamps — G-E FS-4NA, for 40W lamps.

Ask your G-E distributor for latest "G-E Starter Selection Chart and Maintenance Guide for Fluorescent Lighting" (reprinted 3 times!). General Electric Company, Wiring Device Dept., Providence 7, R. I.

GENERAL ELECTRIC

ADVERTISERS' LITERATURE

Offered in ads received up to 5th of last month for this issue. For items you want, circle numbers on Reader Service Card.

PACKAGING & SHIPPING

275—Packaging. Helpful folder illustrates effective product and package identification. Markem Machine Co.

276—Steel strapping. Information covers automatic steel strapping machine Model 12. U. S. Steel Supply.

277—Staplers, staples. Booklet tells "How to Cut Costs on 20 Shipping Room Jobs." Bostitch, Inc.

278—Checkweigher. Bulletin 2968 covers phase-sensitive, plug-in amplified checkweigher scales. Toledo Scale Div.

PRODUCTION

279—Drill presses. Brochure contains complete specifications on new 17-in. models; accessories. Rockwell Mfg. Co.

280—Pumps. Here's new 8-page catalog on Series K—sizes ¾ to 110 gpm, pressures to 400 psi. Roper Hydraulics, Inc.

281—Industrial TV. Write for copy of closed-circuit TV system-planning guide; gives applications. Philco Corp.

282—Air-cooled condenser. Bulletin 139-R presents models—capacities to 30-million Btu.'s. Niagara Blower Co.

283—Phosphate coating. Gives information on coating to improve paint adhesion. Detrex Chemical Industries.

284—Cut-off machine. Literature and prices on Model 8CW-B1 automatic cut-off machine. Kalamazoo Tank & Silo Co.

285—Air-power devices. Spot-A-Mation idea file gives complete data, wiring diagrams, etc. Bellows-Valvair.

286—Lubricants. Lubriplate Data Book is an informative treatise on lubrication. Lubriplate Div., Fiske Bros.

BUILDING

287—Plant Site. All about plant location facilities in Toledo-Northwestern Ohio area. Toledo Edison Co.

288—Nebraska. Data on manufacturers' production capacities in Northern Plains States. Northern Natural Gas Co.

289—Floor plate. Bulletin SD-S10 describes heavy-duty floorplate that's easy to weld. Alan Wood Steel Co.

290—Roofing. Roofing manual (36 pages) includes specifications for complete roof construction. Lion Oil Co.

291—Floor surfacer. Information presented on resilient Portland cement-latex mixture. Pennsalt Chemicals Corp.

292—Multi-plate pipe. Catalog gives specifications, describes adaptability. Armco Drainage & Metal Products, Inc.

PLANT SERVICES

293—Compressor. Bulletin 185 gives complete details on balance/opposed, motor-driven line. Clark Brothers Co.

294—Flexible hose units. Catalog ID-100E with IPB-7C supplement includes applications. Universal Metal Hose Co.

295—Dust collectors. Brochure lists 53 standard models for job-tailored dust collection. Aget Mfg. Co.

296—Work benches. Catalog shows 264 models for arranging customized work centers. Equipto Div., Aurora Equipment.

297—Valved couplings. Catalog No. 58 offers information on sizes to fit varied applications. Snap-Tite, Inc.

298—Compressor. Bulletin 11,003 on Type L Axi-compressors; 29 sizes—to 12,000 cfm. Ingersoll-Rand Co.

299—Safety glasses. Full data on Y-30 line of protective glasses plus safety portfolio. Bausch & Lomb, Inc.

300—Steel equipment. Catalog 100-K describes with illustrations diversified line. Lyon Metal Products, Inc.

301—Drum tops. Full details, plus drum-top kit for converting old drums to waste receptacles. Bennett Mfg. Co.

302—Lockers. Booklet, "12 Losses Penco Planning Can Control," upon request. Alan Wood Steel Co., Penco Div.

303—Meters. Bulletins P-100, PI-566, OG-400 discuss meters for measuring liquids and gases. Rockwell Mfg. Co.

304—Regulators/valves. Bulletins 1044, 1059, 1082, 1086 cover regulation of gas/air pressures. Rockwell Mfg. Co.

305—Valves. Bulletin V-612 describes Multiport valves for controlling liquids, gas, slurries. Rockwell Mfg. Co.

306—Plant protection. Information on centralized control for door and gate control. Minneapolis-Honeywell.

307—Vacuum systems. Catalog 155B gives details on complete systems for dust control. The Spencer Turbine Co.

Turn the page

Circle 520 on Reader Service Card for items on next page

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Quality Control Directors, Dyers, Colorists, Laboratory Technicians, who are dissatisfied with their present color control methods with particular emphasis on the light source. Macbeth Color Matching Equipment is made and designed for the sole purpose of seeing color . . . for formulating, matching, shading, inspection, uniformity.

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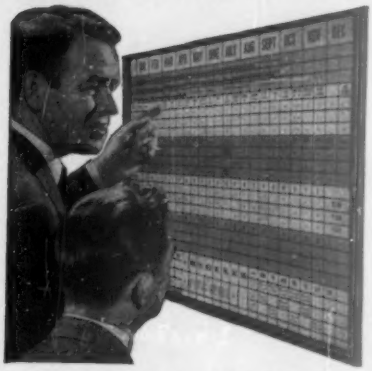

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GRAPHIC SYSTEMS

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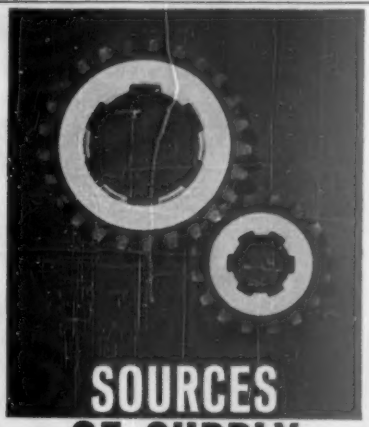


SOURCES OF SUPPLY

Suppliers and sub-contractors in the Northern Plains can be pinpointed quickly by the Facilities Register, a unique electronic index of production facilities. Whether yours is a problem of finding new suppliers, contracting for idle machine time, shortening lines of supply, or obtaining better quality and service:

NORTHERN NATURAL GAS COMPANY

SERVING THE NORTHERN PLAINS ☐ GENERAL OFFICES: OMAHA, NEBRASKA

Begins on page 194

ADVERTISERS' LITERATURE

Offered in ads received up to 5th of last month for this issue. For items you want, circle numbers on Reader Service Card.

308—Paint sprayer. Folder I-3504 presents portable 5-gal. airless sprayer—weighs 17 lb. The DeVilbiss Co.

309—Pumps. Booklet, "Rotary and Centrifugal Pumps: Theory and Design," gives applications. Worthington Corp.

310—Paint. Booklet, "Color Dynamics," tells what it is, how it's used. Paint Div., Pittsburgh Plate Glass Co.

311—Epoxy coatings. Literature on coatings for metal, wood, masonry protection. Hauger-Beegle Associates, Inc.

MECHANICAL

312—Speed reducers. Book 2719 lists complete 57-size line of parallel-shaft speed reducers. Link-Belt Co.

313—Gears. Booklet, "An Advanced Concept in Modern Gearing," covers gear drives. Philadelphia Gear Corp.

314—Speed reducers. Catalog 360 contains information including engineering data. American Stock Gear Div.

315—Adjustable speed drive. Bulletin GEA-6806 describes low-cost compact equipment. General Electric Co.

MATERIAL HANDLING

316—Overhead crane. Bulletin, "The Whiting Standard Tiger Crane," tells full story. Whiting Corp.

317—Steel shelving. Catalog covers simple, adjustable, and rapidly assembled line. Borroughs Mfg. Co.

318—Tote boxes. Details on rectangular boxes—popular sizes with dollies to fit. Wear-Ever Aluminum, Inc.

319—Casters, wheels. New manual describes over 4000 types of casters and their uses. Darnell Corp., Ltd.

320—Containers. Illustrated brochure shows complete line of containers for various applications. G. B. Lewis Co.

321—Storage racks. Catalog gives facts on slide-and-lock adjustable racks. American Metal Products Co.

322—Tractor-shovel. Here's data on H-120B loader—capacity 14,500 lb, speeds to 26 mph. The Frank G. Hough Co.

323—Dumpers. Bulletin (6 pages) has data including capacities, lifting heights. Conveyors & Dumpers, Inc.

324—Steel shelving. Booklet, "12 Losses Penco Planning Can Control," presents data. Alan Wood Steel Co.

325—Sealdbins. Bulletin CP-59-41 gives complete details on new bulk-handling system. U. S. Rubber Co.

326—Remote control system. Bulletin 187 discusses industrial switching locomotives. Union Switch & Signal Div.

327—Tramrails. Booklet 2032 covers overhead handling equipment and new "Tarca" track. Cleveland Tramrail Div.

328—Conveyor. Catalog A-580 describes new floor-type carousel conveyor. Adaptable. Richards-Wilcox Mfg. Co.

ELECTRICAL

329—Precision switches. Catalog 83 has 20 pages of information on enclosed switches. Micro Switch.

330—Fluorescent starters. Selection chart, lighting maintenance guide. Wiring Device Dept., General Electric Co.

331—Silicone insulation. Write for brochure, "Specify Silicone Insulated Equipment and Save." Dow Corning Corp.

332—Control system. Bulletin SM-307 gives construction details, dimensions of new 300-volt control. Square D Co.

333—Motor starters. Publication 6100 has data on Bulletins 712 and 713 combination starters. Allen-Bradley Co.

334—Motor starters. Bulletin 6080 gives details on 1500-hp. 2300-v., 2500-hp. 4600-v. models. Allen-Bradley Co.

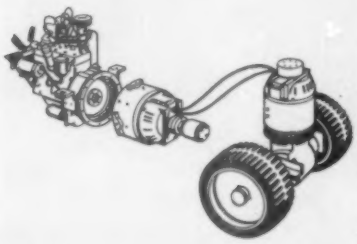
Technology Reports

219 Synthetic Adhesives
221 Spot Heating
227 Production Counting
231 Scrap Recovery
234 Production Painting
239 Noise Control
242 Compressed Air Systems
248 Maintenance Painting
252 Non-Destructive Testing
258 Pumps
268 Lubrication
273 Steel Shelving

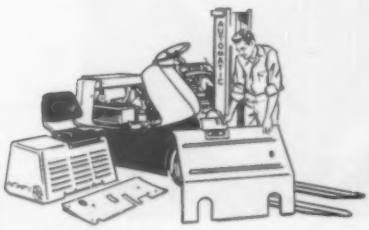
Cost: 35¢ ea.; set of any 4, $1. Order from Reader Service, FACTORY, 330 W. 42nd St., New York 36.

HERE'S HOW *ASD** MAKES THE MODEL GLF MORE ECONOMICAL, EASIER TO SERVICE

Electric drive efficiency — Since there is no direct coupling between engine and drive axle, engine speed is not dependent on truck speed. This means torque can be varied by the requirements of the load and that the engine can operate at its most efficient speed at all times. This efficiency has been proven in railroad use with the result that almost every locomotive in operation today is powered by a Diesel-electric unit.



Simplified power train—Engine plus variable voltage generator (one moving part) connected by two wires to electric drive motor (one moving part) equal *Advanced Simplified Design. This completely job-proven drive, as standard equipment on the GLF Series trucks, senses the power needs and automatically adjusts to varying torque and speed requirements. There are no shifting gears, no friction clutches, no slushing oil, no valving or piping—virtually nothing to wear out or cause trouble so common to other types of automatic transmissions.



Easy maintenance—All parts are easily accessible for maintenance by removing three pieces of shrouding—engine cover, floor board, and front cowling. Hydraulic pump can be removed by disconnecting two hydraulic fittings and unscrewing two bolts. Brakes can be adjusted without removing the wheels.

GAS-POWERED TRUCK WITH HIGH-EFFICIENCY TRANSMISSION

cuts fuel costs as much as 30%

There's a big difference in gas-powered trucks . . . and the AUTOMATIC Model GLF has the difference that makes real savings in fuel costs and maintenance expenses.

Actual field tests have shown the Model GLF's exclusive electric drive delivers gas savings up to 30%, compared to other types of automatic transmissions. The Model GLF is available in capacities of 3,000 through 10,000 lbs. with cushion tires; 3,000 through 8,000 lbs. with pneumatic tires. Choice of gas or LPG.

This is one more example of how AUTOMATIC has engineered lift trucks with *Advanced Simplified Design to give you more dependable, more economical trucks for the money. It's another reason why it pays to contact your nearby AUTOMATIC dealer when you need lift trucks. Call him . . . or mail coupon for full details on the Model GLF series.

Only AUTOMATIC trucks have *Advanced Simplified Design

AUTOMATIC®

A Division of The Yale & Towne Manufacturing Company

39 West 87th Street, Dept. X1, Chicago 20, Illinois

Please send Facts and Factors Brochure on Model GLF gas-powered lift trucks.

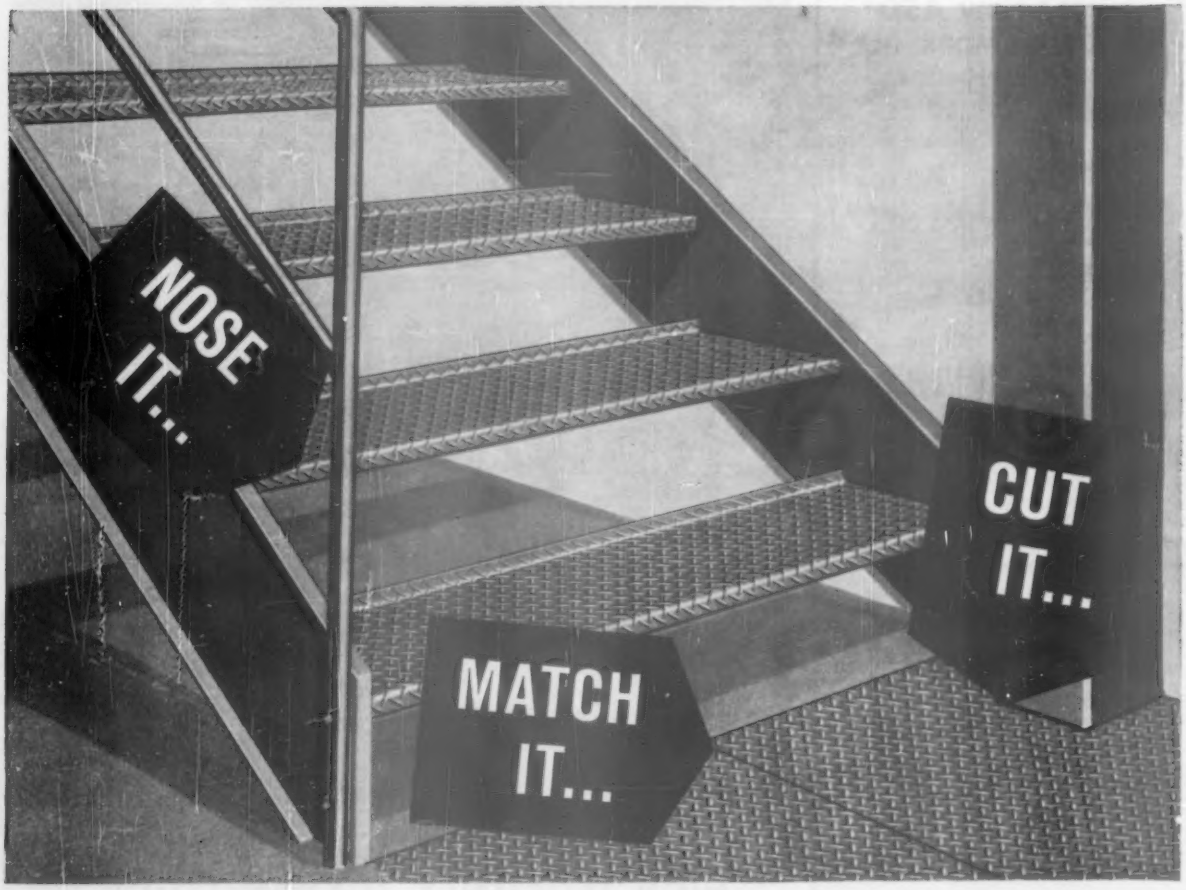
Name_____ Title_____

Company_____

Street_____

City_____ Zone____ State_____

For more facts Circle 523 on Reader Service Card

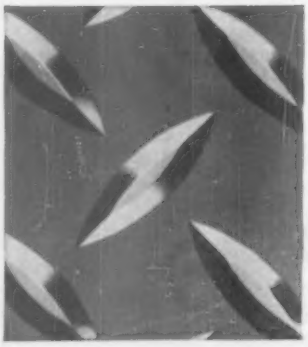


Alan Wood Super Diamond floor plate ...is easy to fabricate

Here's a heavy duty floor plate that can be sheared, formed, welded, and easily matched. The arrangement of the unique A. W. Super Diamond pattern allows you to bend it at any place.

A. W. Super Diamond will last for years... provides a safe, non-skid footing at all times. Easy to clean? A. W. Super Diamond can be swept, hosed or mopped easily . . . from any angle.

For easy fabrication and installation... for safety... for long wear ...specify A. W. Super Diamond. Write for Bulletin SD-S10.



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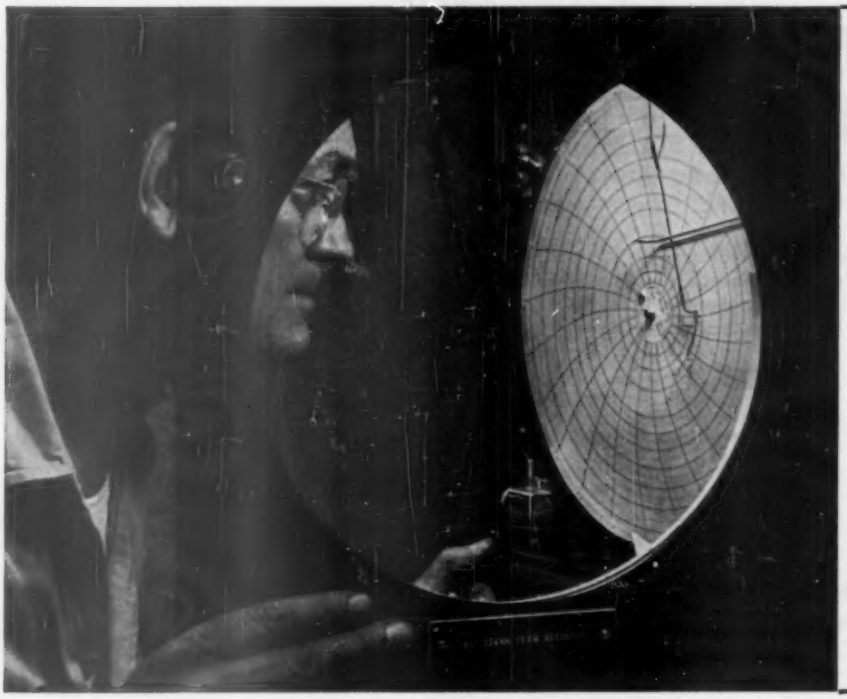
For more facts Circle 524 on Reader Service Card

Which of these round chart recorder inking problems do you now have?



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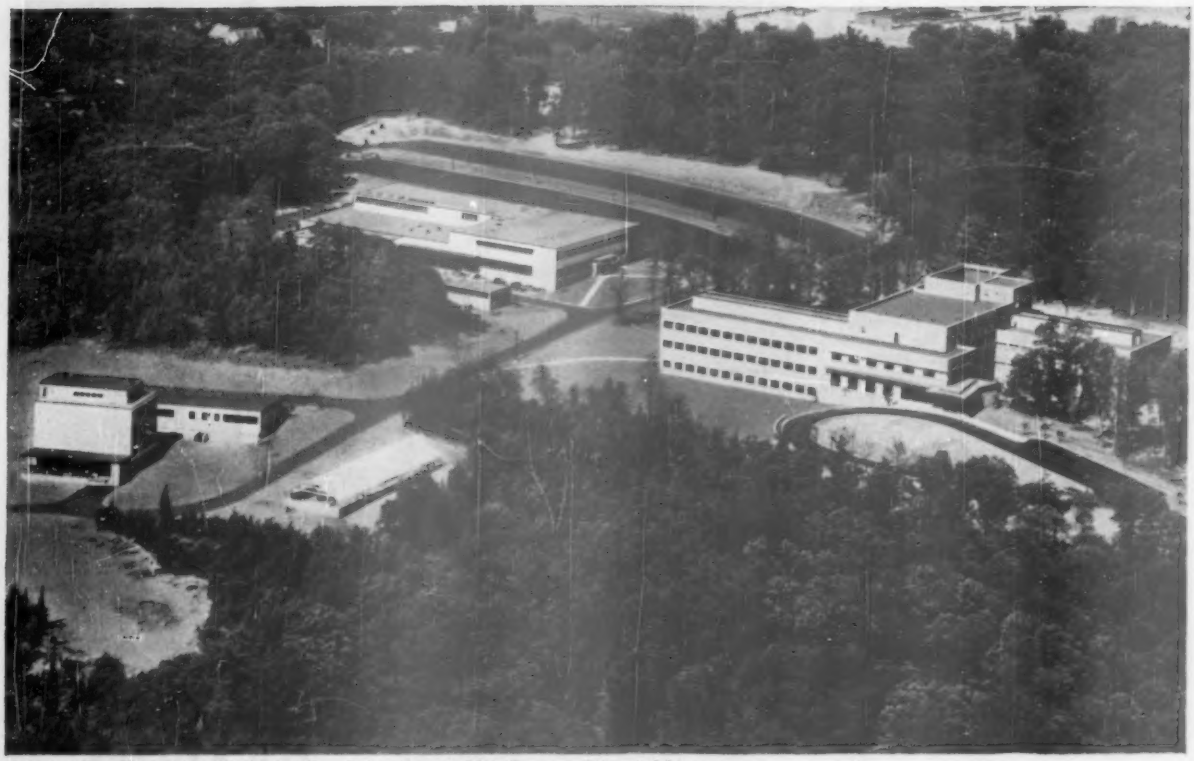

Chemical Eng. Bldg. at left; Mechanical Eng. Bldg. at center; Main Research Bldg. at right.

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U. S. RUBBER RESEARCH CENTER

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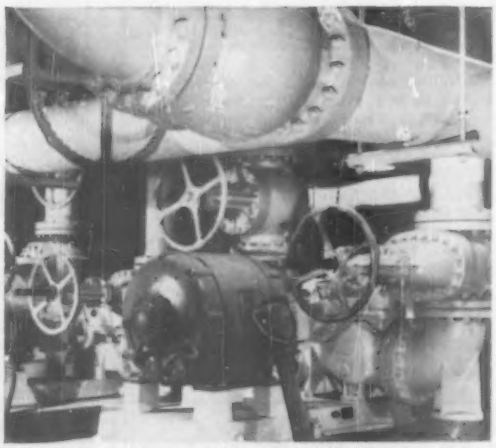

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(Classified Advertising)
F. J. Eberle, Business Mgr.

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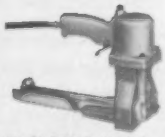
BOSTITCH staplers secure shipments, savings and efficiency

Model D16 Top Stapler seals tops of corrugated containers across seam entirely from outside. Lightweight for easy operation and portability. Drives wide-crown staples and clinches them inside work.



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1—Drilling machines
2—Processing machines
3—Spot welder
4—Tooling, accessories
5—Filtration equipment
6—Infra-red ovens
7—Drill heads
8—Infra-red equipment
9—Fasteners
10—Templets

BUILDING
11—Metal roofing, siding
12—Steel flooring
13—Partitions
14—Acoustical materials

MATERIAL HANDLING
15—Lightweight conveyor
16—Storage racks
17—Packaging
18—Systems controls
19—Lifting magnets
20—Lifts, ramps
21—Cranes
22—Collapsible containers
23—Conveyors
24—Fork truck
25—Crane

MECHANICAL
26—V-belt drives
27—Accumulators
28—Bearings
29—Differentials
30—Hydraulic filters

VALVES, FITTINGS
31—Vacuum valves
32—Valve systems
33—Couplings
34—Gate valves
35—Ball valves
36—Valve sizing

MAINTENANCE
37—Plant maintenance
38—Chain lubrication
39—Incinerators
40—Equipment care
41—Fire pump controllers
42—Fire guards

ELECTRICAL
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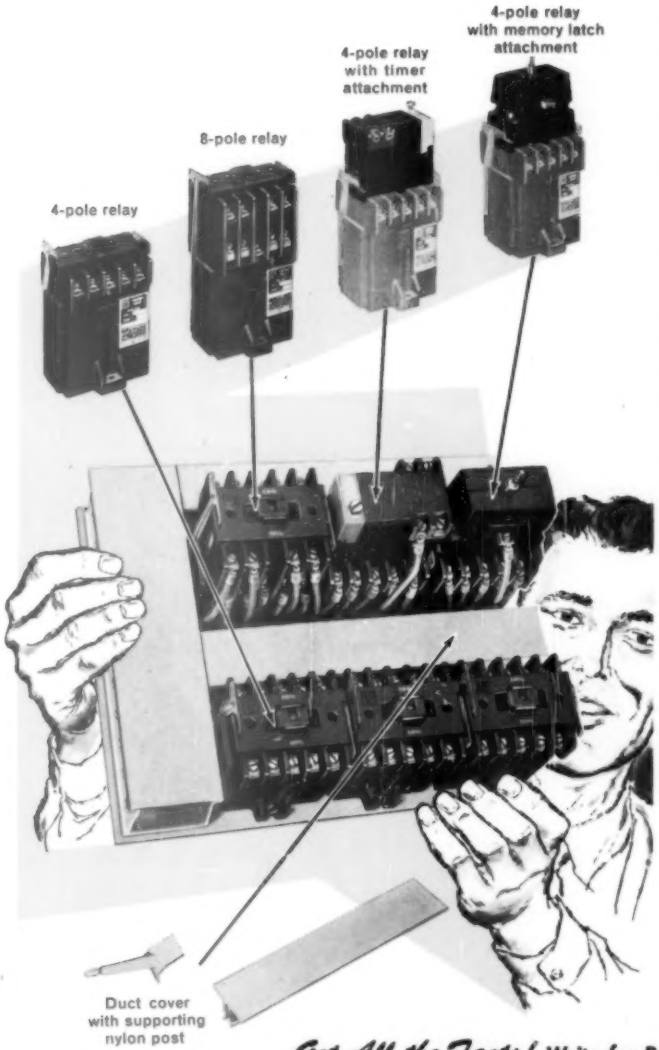
44—Switchgear
45—High-temperature wires
46—Transformers

LIGHTING
47—Lighting fixtures
48—Stand-by lights
49—Area lighting
50—Troffers

AUXILIARY
51—Water heating equipment
52—Boiler feedwater treatment
53—Fuel oil heaters
54—Air handling troffer
55—Infra-red heating
56—Waste treatment
57—Heaters
58—Steam-heating specialties

INSTRUMENTS AND CONTROLS
59—Liquid level switches
60—Contactors, starters
61—Tachometers
62—Instrument counters

NEW
Square D 300-volt Control System
for Outstanding Versatility, Drastically Reduced Panel Space!


4-pole relay with memory latch attachment
4-pole relay with timer attachment
8-pole relay
4-pole relay
Duct cover with supporting nylon post

Here's the most advanced, easiest-to-use control system ever built! Just two basic relays plus two attachments (latching mechanism and timer) fill all your requirements. Square D's new **Type G 10-ampere relay** is small—has convertible contacts—can be disassembled in seconds without removing wiring—is manually operable. You get all these advantages with Square D's new 300-volt control system!

Saves panel space • Small relay size plus drastically reduced wiring space requirements mean the most compact panel you can build!

Convertible contacts • Change from normally open to normally closed (or vice versa) without removing a screw, without adding a single part, without touching the stationary contacts or removing any wiring! Just flip over the movable contact with a screwdriver. All contacts double-break, individually convertible for any combination you need.

Makes its own duct • Snap molded nylon posts into ¼-inch holes on panel, snap duct cover on posts—and your duct is complete! All terminals remain out in the open—you can change relays, convert contacts, add timer or latching mechanism without disturbing duct. Because device and duct mounting are independent, relay spacing and alignment are not critical.

Timer and memory latch attachments can be added in just seconds! Simply lift up and slide back the relay latches, remove the cover and slip on the desired attachment. Attachments require no additional panel space! Timer easily changed from on-delay to off-delay, is adjustable from 0.2 second to 1 minute.

Get All the Facts! Write for Bulletin SM-307 for construction details, dimensions, ordering information—the complete story on the new Square D 300-volt control system. Square D Company, Dept. SA, 4041 North Richards Street, Milwaukee 12, Wisconsin

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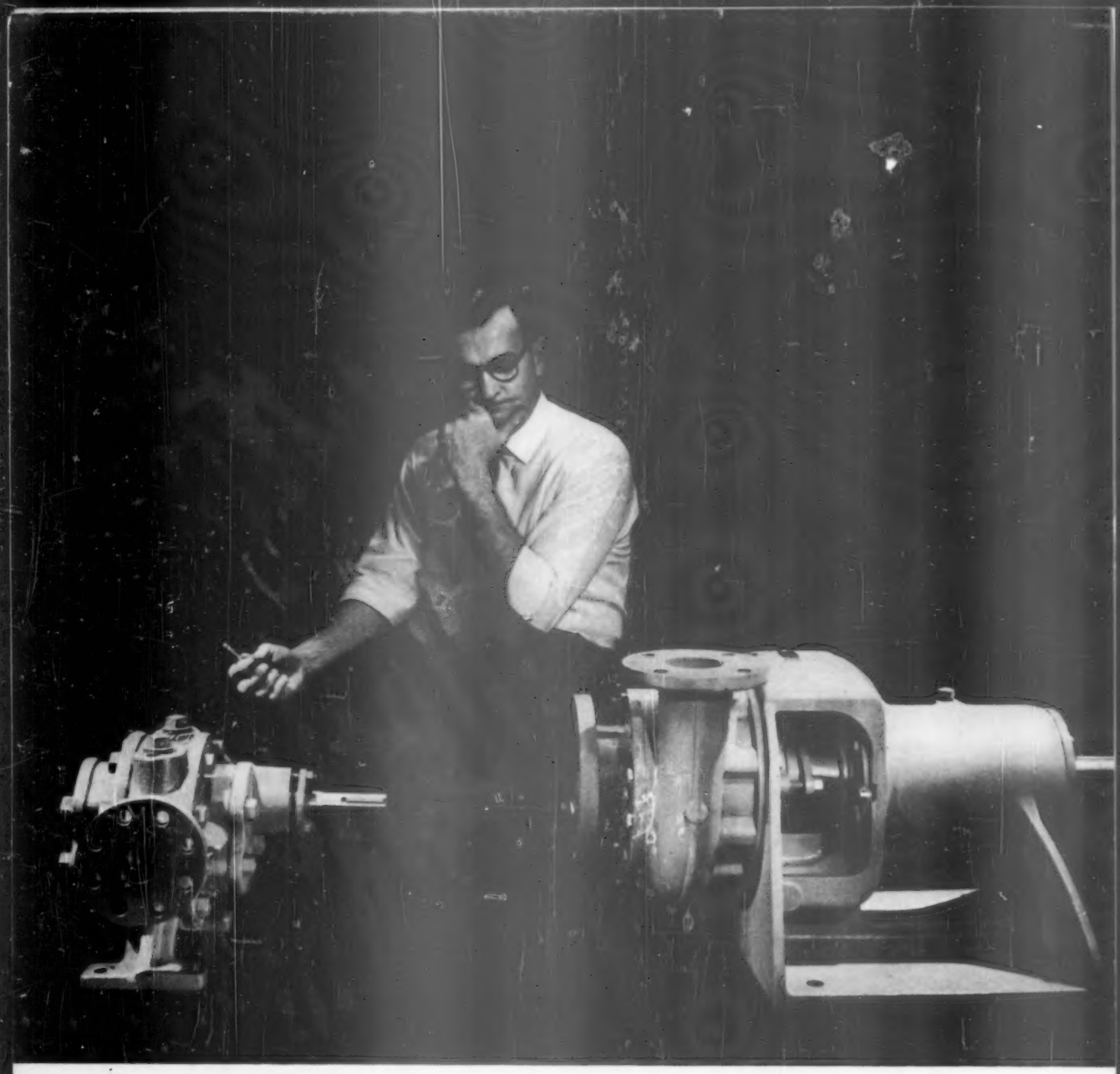
For more facts circle 405 on READER SERVICE CARD



ROTARY OR CENTRIFUGAL

...Which one is best for your application?

Rotary or centrifugal? Sometimes the choice is easy. For example, you would use a rotary pump for very viscous liquids (over 2500 s.s.u.). Or where poor suction conditions exist. Or when positive displacement is required. Centrifugal pumps would be used for extremely corrosive or abrasive liquids, low viscosity liquids (under 2500 s.s.u.) water, slurries, or petroleum products.

But . . . in many applications combinations of these factors exist. Or the liquid you want to pump is not clearly in either area. Then there are other considerations such as initial cost, operating cost, lubrication value of the liquid, location and even budget limitations.

All of these considerations can put you in the middle—where either a rotary or centrifugal can be used. The best choice can only be made by someone with experience and knowledge of both types.

As one of the few manufacturers of a complete line of both rotary and centrifugal pumps, Worthington can help you select the best, most economical solution to this perennial pump problem. For the name and address of your nearest Worthington representative, consult the yellow pages.

P.S. If you'd like a copy of a 50-page booklet, "Rotary and Centrifugal Pumps: Theory and Design," please write to Worthington Corporation, Section 20-14, Harrison, New Jersey, for bulletin G-2666.

WORTHINGTON

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